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ENVIRONMENTAL MONITORING REPORT FOR THE NEVADA TEST SITE AND OTHER TEST AREAS USED FOR UNDERGROUND NUCLEAR DETONATIONS

January through December 1974

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by the

Monitoring Applications Laboratory

National Environmental Research Center

U. S. ENVIRONMENTAL PROTECTION AGENCY

Las Vegas, Nevada

Published May 1975

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This work performed under a Memorandum of Understanding No. AT(26-1)-539) for the U. S. ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION

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Report No. NERC-LV-539-39

By the National Environmental Research Center, United States Environmental Protection Agency, Las Vegas, Nevada 89114

The attached new pages 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 97, 98, 101, 102, 103 and 104 should be inserted to replace the previous corresponding pages which contained inconsistencies.

PREFACE

The Atomic Energy Commission (AEC) has used the Nevada Test Site (NTS) from January 1951 through January 19, 1975, as an area for conducting nuclear detonations, nuclear rocket-engine development, nuclear medicine studies, and miscellaneous nuclear and non-nuclear experiments. Beginning on January 19, 1975, these responsibilities were transferred to the newly formed Energy Research and Development Administration (ERDA). Atmospheric nuclear tests were conducted periodically from 1951 through October 30, 1958, at which time a testing moratorium was implemented. Since September 1, 1961, in accordance with the limited test ban treaty, all nuclear detonations have been conducted underground with the expectation of containment except for four slightly above ground or shallow underground tests of Operation Dominic II and five nuclear earth-cratering experiments conducted under the Plowshare program.

The U. S. Public Health Service (PHS) from 1953 through 1970 and, since 1970, the U. S. Environmental Protection Agency (EPA) have maintained facilities at the NTS or in Las Vegas, Nevada, for the purpose of providing an Off-Site Radiological Safety Program for the nuclear testing program. Prior to 1953, this program was performed by the Los Alamos Scientific Laboratory and by U. S. Army personnel. Although off-site surveillance has been provided by the Las Vegas facility for nuclear explosive tests at places other than the NTS, the primary surveillance effort has been centered around the NTS.

The objective of the Program since 1953 has been to measure levels and trends of radioactivity in the off-site environment surrounding testing areas to assure that the testing is in compliance with existing radiation protection standards. To assess off-site radiation levels, routine sampling networks for milk, water, and air are maintained along with a dosimetry network and special sampling of food crops, soil, etc., as required.

In general, analytical results showing radioactivity levels above naturally occurring levels have been published in reports covering a test series of test project. Beginning in 1959 for reactor tests, and in 1962 for weapons tests, surveillance data for each individual test which released radioactivity off-site were reported separately. Commencing in January 1964, and continuing through December 1970, these individual reports for nuclear tests were also summarized and reported every six months with the analytical results for all routine or special milk samples.

In 1971, the AEC implemented a requirement (ERDA Manual, Chapter 0513)[1] for a comprehensive radiological monitoring report from each of the several contractors or agencies involved in major nuclear activities. The compilation of these various reports since that time and their entry into the general literature serve the purpose of providing a single source of information concerning the environmental impact of nuclear activities. To provide more rapid dissemination of data, the monthly reports of analytical results of all air data collected since July 1971, and all milk and water samples collected since January 1972, are submitted to the appropriate state health departments involved, and were also published in Radiation Data and Reports a monthly publication of the EPA, which was discontinued at the end of 1974.

Since 1962, PHS/EPA aircraft have also been used during nuclear tests to provide rapid monitoring and sampling for releases of radioactivity. Early aircraft monitoring data obtained immediately after a test are used to position mobile radiation monitors, and the results of cloud sampling are used to quantitate the inventories, diffusion and transport of the radionuclides released. Beginning in 1971, all monitoring and sampling results of aircraft have been reported in effluent monitoring data reports in accordance with the ERDA Manual, Chapter 0513.

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INTRODUCTION

Under a Memorandum of Understanding, No. AT(26-1)-539, with the U. S. Energy Research and Development Administration (ERDA), the U. S. Environmental Protection Agency (EPA), National Environmental Research Center-Las Vegas (NERC-LV), continued its Off-Site Radiological Safety Program within the environment surrounding the Nevada Test Site (NTS) and at other sites designated by the ERDA during 1974. This report, prepared in accordance with the ERDA Manual, Chapter 0513, contains summaries of NERC-LV sampling methodologies, analytical procedures, and the results of environmental samples collected in support of ERDA nuclear testing activities. Where applicable, sampling data are compared to appropriate guides for external and internal exposures to ionizing radiation. In addition, a brief summary of pertinent and demographical features of the NTS and the NTS environs is presented for background information.

NEVADA TEST SITE

The major programs conducted at the NTS in the past have been nuclear weapons development, proof-testing and weapons safety, testing for peaceful uses of nuclear explosives (Project Plowshare), reactor/engine development for nuclear rocket and ram-jet applications (Projects Rover and Pluto), basic high-energy nuclear physics research, and seismic studies (Vela-Uniform). During this report period, these programs were continued with the exception of Project Pluto, discontinued in 1964, and Project Rover, which was terminated in January 1973. No Plowshare nuclear tests were conducted at the NTS or any other site during this period. All nuclear weapons tests were conducted underground to minimize the possible release of fission products to the atmosphere.

Site Location

The Nevada Test Site (Figures 1 and 2) is located in Nye County, Nevada with its southeast corner about 90 km northwest of Las Vegas. The NTS has an area of about 3500 km^2 and varies from 40-56 km in width (east-west) and from 64-88 km in length (north-south). This area consists of large basins or flats about 900-1200 m above mean sea level (MSL) surrounded by mountain ranges 1800-2100 m MSL.

The NTS is nearly surrounded by an exclusion area collectively named the Nellis Air Force Range. The Range, particularly to the north and east, provides a buffer zone between the test areas and public lands. This buffer zone varies from 24-104 km between the test area and land that is open to the public. Depending upon wind speed and direction, this provides a delay of one half hour to more than 6 hours before any accidental release of airborne radioactivity could pass over public lands.

Climate

The climate of the NTS is variable, primarily due to altitude and the rugged terrain. Generally, the climate is referred to as Continental Arid. The average annual precipitation ranges from about 10 cm at the 900-m altitude to around 25 cm on the plateaus. During the winter months, the plateaus may be snow-covered for periods of several days or weeks. Snow is uncommon on the flats. Temperatures vary considerably with elevation, slope, and local air currents. The average daily high (low) temperatures at the lower altitudes are around 10° (-4°) C in January and 35° (12°) C in July, with extremes of 44° and -26° C. Corresponding temperatures on the plateaus are 2° (-4°) C in January and 26° (18°) C in July with extremes of 38° and -29° C. Temperatures as low as -34° C and higher than 46° C have been observed at the NTS.

The prevailing direction from which winds blow, as measured on a 30-m tower at the Yucca observation station, is predominantly northerly except for the months of May through August when winds from the south-southwest predominate. Because of the prevalent mountain/valley winds in the basins, south to southwest winds predominate during daylight hours during most months. During the winter months southerly winds have only a slight edge over northerly winds for a few hours during the warmest part of the day. These wind patterns may be quite different at other locations on the NTS because of local terrain effects and differences in elevation.[2]

Geology and Hydrology

Geological and hydrological studies of the NTS have been in progress by the U. S. Geological Survey and various other institutions since 1956. Because of this continuing effort, including subsurface studies of numerous boreholes, the surface and underground geological and hydrological characteristics for much of the NTS are known in considerable detail. This is particularly true for those areas in which underground experiments are conducted. A comprehensive summary of the geology and hydrology of the NTS was published in 1968 as Memoir 110 by the Geological Society of America, entitled "Nevada Test Site."

There are two hydrologic systems on the NTS (Figure 3). Groundwater in the Pahute Mesa system is believed to travel somewhere between 2 and 80 m per year to the south and southwest toward the Amargosa Desert. It is estimated that groundwater in the Ash Meadows system moves beneath the NTS from north to south at a rate not less than 2 nor greater than 220 m per year.[3] Carbon-14 analyses of water from the Ash Meadows systems indicate that the lower velocity is nearer the true value. At Mercury Valley, in the extreme southern part of the NTS, the groundwater flow direction shifts to the southwest toward the Ash Meadows discharge area in the southeastern Amargosa Valley.

Depths to water on the NTS vary from about 100 m beneath the valleys in the southeastern part of the site to more than 600 m beneath the highlands to the north. Although much of the valley fill is saturated, downward movement of water is extremely slow. The primary aquifer in these formations is the Paleozoic carbonates which underlie the more recent tuffs and alluviums.[3]

Land Use of NTS Environs

Figure 4 is a map of the off-NTS area showing general land use. A wide variety of uses exists due to the variable terrain. For example, within a 320-km radius west of the NTS, elevations range from below sea level in Death Valley, to 4420 m above MSL in the Sierra Nevada Range. Additionally, parts of two valleys of major agricultural importance (the Owens and San

Joaquin) are included. The areas south of the NTS are more uniform since the Mojave Desert ecosystem comprises most of this portion of Nevada, California, and Arizona. The areas east of the NTS are primarily Basin-Range Desert with some of the older river valleys, such as the Virgin River Valley, supporting small-scale but intensive farming and production of a variety of crops. Grazing is also common in this area, particularly to the northeast. The area north of the NTS is also Basin-Range Desert where the major agricultural-related activity is grazing of both cattle and sheep. Only areas of minor agricultural importance, primarily alfalfa hay, are found in this portion of the State within a distance of 320 km.

In the summer of 1974, a brief survey of home gardens around the NTS found that a major portion of the residents grow or have access to locally grown fruits and vegetables. Approximately two dozen of the surveyed gardents within 30 km of the NTS were selected for sampling. These gardens produce a variety of root, leaf, seed, and fruit crops.

The only major body of water close to the NTS is Lake Mead, a man-made lake supplied by water from the Colorado River. Lake Mead is the source of water for almost all domestic, recreational, and industrial purposes in the Las Vegas Valley and for a portion of the water used by Southern California. Smaller reservoirs and lakes located in the area are primarily for irrigation and for livestock. In California, the Owens River and Haiwee Reservoir feed into the Los Angeles Aqueduct and are the major sources of domestic water for the Los Angeles area.

Dairy farming is not extensive within the 320-km-radius area under discussion. From a survey of milk cows in the area during this report period, a total of 12,721 dairy cows and 1,174 family cows were located. The family cows are found in all directions around the test site, while the dairy cows are primarily located southeast of the test site (Moapa River Valley, Nevada; Virgin River Valley, Nevada; and Las Vegas, Nevada), northeast (Hiko and Alamo, Nevada, area), west-northwest (near

Bishop, California), and southwest (near Barstow, California) (Figure 5).

Population Distribution

Based upon a field survey during 1974, Figure 5 portrays the distribution of people and milk cows within a 320-km radius of the Control Point, CP-1, at the NTS. With the exception of Las Vegas and vicinity, there are no major population centers within 320 km of the site. There are about 500,000 people living in this total area, about one-half of whom live in the Las Vegas greater metropolitan area. If the City of Las Vegas is not considered in determining population density, there are about 0.8 people per km^2 (2 people per mi^2) within the 320-km radius of the NTS Control Point. For comparison, the United States (50 states) has a population density of 21 people per km^2 and the overall Nevada average is 1.7 people per km^2.

The off-site areas within about 80 km of NTS are predominantly rural. Several small communities are located in the area, the largest being in the Pahrump Valley. This rural community, with an estimated population of about 3000, is located about 72 km south of the NTS. The Amargosa Farm area has a population of about 200 and is located about 50 km southwest of the center of the NTS. The Spring Meadows Farm area is a relatively new development consisting of approximately 10,000 acres with a population of somewhat more than 100. This area is about 55 km south-southwest of the NTS. The largest town in the near off-site area is Beatty with a population of about 1000; it is located about 65 km to the west of the site.

In the adjacent states, the Mojave Desert of California, which includes Death Valley National Monument, lies along the southwestern border of Nevada. The population in the Monument boundaries varies considerably from season to season with fewer than 200 permanent residents and tourists in the area during any given period in the summer months. However, during the winter as many as 2000 tourists and campers can be in the area on any particular day during the major holiday periods. The largest town in this general area is Barstow, located 265 km south-southwest of the NTS, with a population of about 17,000.

The Owens Valley, where numerous small towns are located, lies about 50 km west of Death Valley. The largest town in Owens Valley is Bishop, located 225 km west-northwest of the NTS, with a population of about 8500.

The extreme southwestern region of Utah is more developed than the adjacent part of Nevada. The largest town, Cedar City, with a population of approximately 8000, is located 282 km east-northeast of the NTS. The next largest community is St. George, located 217 km east of the NTS, with a population of slightly more than 7000.

The extreme northwestern region of Arizona is mostly undeveloped range land with the exception of that portion in the Lake Mead Recreation Area.

Several small retirement communities are found along the Colorado River, primarily at Lake Mojave and Lake Havasu. The largest town in the area is Kingman, located 280 km southeast of the NTS, with a population of about 6000.

OTHER TEST SITES

Table 1 lists the name, date, location, yield, depth, and purpose of all underground nuclear tests conducted at locations other than the NTS. No off-NTS nuclear tests were conducted during this report period. However, production testing of a natural gas well at the Project Rio Blanco site near Rifle, Colorado, was conducted in January, February, and December 1974,[4,5,6] during which time natural gas containing quantities of ^{85}Kr and ^{3}H was flared (burned) in the open. CER Geonuclear Corporation, the contractor responsible for the off-site radiological safety program for this operation, will report separately the results of their environmental surveillance.

SUMMARY

During 1974, the monitoring of gamma radiation levels in the environs of the NTS was continued through the use of an off-site network of radiation dosimeters and gamma-rate recorders. Concentrations of radionuclides in pertinent environmental media were also continuously or periodically monitored by established air, milk and water sampling networks. Before each underground nuclear detonation, mobile radiation monitors, equipped with radiation monitoring instruments and sampling equipment, were on standby in off-NTS locations to respond to an accidental release of airborne radioactivity.

A total of about 707 curies (Ci) of radioactivity, primarily radioxenon, was reported by ERDA/NV as being released intermittently throughout the year. The only off-NTS indications of this radioactivity from test operations were concentrations of ^{133}Xe measured in air samples collected at Beatty and Diablo, Nevada. The concentrations at these locations when averaged over the year were less than 0.008% of the Concentration Guide of 1×10^{-7} microcuries per milliliter (μCi/ml) as listed in the ERDA Manual, Chapter 0524, for exposure to a suitable sample of the population. Based upon time-integrated concentrations of ^{133}Xe at these locations, dose calculations, and population information, the dose commitment to persons within 80 km of the NTS Control Point for test operations during this year was estimated to be 0.003 man-rem.

All other measurements of radioactivity within the Off-Site Radiological Safety Program were attributed to naturally occurring radioactivity or atmospheric fallout and not related to underground nuclear test operations during this report period.

The Long-Term Hydrological Monitoring Program used for the monitoring of radionuclide concentrations in surface and ground waters which are down-gradient from sites of past underground nuclear tests was continued for the NTS and for six other sites located elsewhere in Nevada, Colorado, New Mexico, and Mississippi. Concentrations of naturally occurring radionuclide

such as isotopes of uranium and ^{226}Ra, were detected in samples collected at most locations at levels which were comparable to concentrations measured for previous years. Except for a sample collected at Half Moon Creek Overflow, Mississippi (Project Dribble), and samples collected at wells known to be contaminated by the injection of high concentrations of radioactivity for waste disposal or tracer studies, no radioactivity related to past underground tests or to the contaminated wells was identified. The annual surface water sample collected at Half Moon Creek Overflow had a ^3H concentration of 5.1×10^{-6} µCi/ml. Since the above background concentration for this year is only 0.17% of the Concentration Guide for individuals in an uncontrolled area, no further sampling was done prior to the next scheduled sampling in 1975.

MONITORING DATA COLLECTION, ANALYSIS, AND EVALUATION

The major portion of the Off-site Radiological Safety Program for the NTS consists of continuously-operated dosimetry and air sampling networks and scheduled collections of milk and water samples at locations surrounding the NTS. Before each nuclear test, mobile monitors were positioned in the off-site areas most likely to be exposed by a possible release of radioactive material. These monitors, equipped with radiation survey instruments, gamma-rate recorders, thermoluminescent dosimeters, portable air samplers, and supplies for collecting environmental samples, were prepared to conduct a monitoring program directed from the NTS Control Point via two-way radio communications. In addition, for each event at the NTS, a U.S. Air Force aircraft with two Reynolds Electrical and Engineering Co. monitors equipped with portable radiation survey instruments was airborne near surface ground zero to detect and track any radioactive effluent. Two NERC-LV cloud sampling and tracking aircraft were also available to obtain in-cloud samples, assess total cloud volume, and provide long-range tracking in the event of a release of airborne radioactivity.

During this report period, only underground nuclear detonations were conducted. All detonations were contained. However, during re-entry drilling operations, occasional inadvertent releases of airborne radioactivity, primarily radioxenon, did occur. According to information provided by the Nevada Operations Office, ERDA, the following quantities of radionuclides were released into the atmosphere during CY 1974:

Radionuclide	Quantity Released (Ci)
^{133}Xe	663
^{133m}Xe	11
^{135}Xe	31
^{3}H	< 2
^{238}U	< 0.0001
$^{131,133,135}I$	< 0.00001

Contained within the following sections of this report are descriptions for each surveillance network and interpretations of the analytical results which are summarized (maximum, minimum, and average concentrations) in tables.

Where appropriate, the average values in the tables are compared to the applicable Concentration Guides (CG's) listed in Appendix A.

The Pu in Soil Survey has been a subject of this report for previous years; however, it is actually a special study and not related to routine off-NTS surveillance for current nuclear tests. Henceforth, the data derived from this program will be published in progress reports of the Nevada Applied Ecology Group, sponsored by the ERDA, Nevada Operations Office.

For "grab" type samples, radionuclide concentrations were extrapolated to the appropriate collection date. Concentrations determined over a period of time were extrapolated to the midpoint of the collection period. Concentration averages were calculated assuming that each concentration less than the minimum detectable concentration (MDC) was equal to the MDC. The only exception to this was for the radionuclide measurements for the Air Surveillance Network. Due to the lack of a statistically derived MDC, the concentrations of radionuclides that could not be detected were assumed to be zero.

All radiological analyses referred to within the text are briefly described in Table 2 and listed with the minimum detectable concentrations (MDC's). To assure validity of the data, analytical personnel routinely calibrate equipment, split selected samples (except for the Air Surveillance and Dosimetry Networks) for replicate analyses, and analyze spiked samples prepared by the Quality Assurance Branch, NERC-LV, on a quarterly basis. All quality assurance checks for the year identified no problems which would affect the results of this report.

AIR SU[illegible]CE NETWORK

[illegible] Surveillance Network, operated by the NERC-LV, consisted of 49 active [illegible] 72 standby sampling stations located in 21 Western States (Figure 6). Samples of airborne particulates were collected continuously at each active station on 10-cm-diameter, glass-fiber filters at a flow rate of about 350 m^3 of air per day. The filter collection frequency was three times weekly, resulting in 48- or 72-hour samples from each active station. Activated charcoal cartridges directly behind the glass-fiber filters were used regularly for the collection of gaseous radioiodines at

21 stations near the NTS. Charcoal cartridges could have been added to all other stations, if desired, by a telephone request to station operators. All air samples (filters and cartridges) were mailed to the NERC-LV for analysis. Special retrieval could have been arranged at selected locations in the event a release of radioactivity was believed to have occurred.

From gamma spectrometry results, small concentrations of ^{7}Be, ^{95}Zr, ^{103}Ru, ^{106}Ru, ^{140}Ba, ^{141}Ce and ^{144}Ce in varying combinations were identified at all Network stations except Currant and Geyser, Nevada. Table 3 lists the maximum, minimum and average concentrations of these radionuclides for each station at which radionuclides were detected. Since none of the radionuclides were attributed to NTS testing operations, percentages of the concentration guides were not calculated.

The sources of the radioactivity were considered to be the June 26, 1974, nuclear detonation by the People's Republic of China and worldwide fallout from previous atmospheric tests. The radionuclide ^{140}Ba (12.8-day half-life), which is not usually detected except during short periods following an atmospheric detonation, was detected in 19 ASN stations only between June 28 and July 12. The other radionuclides were detected throughout the Network and year within the ranges, shown below, which are comparable to the results of samples collected within North America during the period January-November 1974 and analyzed by HASL.[7]

		Radionuclide Concentration, $10^{-12}\mu Ci/ml$			
		NTS Network (Jan.-Dec. 1974)		North America (Jan.-Nov. 1974)	
Radionuclide	Half-Life (days)	C_{Max}	C_{Min}	C_{Max}	C_{Min}
^{7}Be	53.3	0.40	≤0.13	0.247	0.0249
^{95}Zr	65.5	1.2	≤0.022	0.0697	0.00170
^{103}Ru	39.6	0.36	≤0.020	Not Reported	
^{106}Ru	369	1.1	≤0.015	Not Reported	
^{141}Ce	32.5	0.28	≤0.031	Not Reported	
^{144}Ce	284	1.0	≤0.13	0.144	0.00241

The NTS concentration ranges were slightly higher than the concentration ranges reported by HASL; however, the difference was not attributed to testing operations at the NTS.

NOBLE GAS AND TRITIUM SURVEILLANCE NETWORK

The Noble Gas and Tritium Surveillance Network, which was first established in March and April 1972, was operated to monitor the airborne levels of radiokrypton, radioxenon, and ^{3}H in the forms HT, HTO, and CH_3T. The Network consisted of four on-NTS and six off-NTS stations (Figure 7).

The equipment used in this Network is composed of two separate systems, a compressed air sampler and a molecular sieve sampler. The compressed air equipment continuously samples air over a 7-day period. The air is then compressed and stored in two pressure tanks, which together hold approximately 2 cubic meters of air at atmospheric pressure. The bottles are replaced weekly and returned to the NERC-LV where the contents of one pressure tank are separated and analyzed for ^{85}Kr, radioxenons, and CH_3T by gas chromatography and liquid-scintillation counting techniques (Table 2). The molecular sieve equipment samples air through a filter to remove particulates and then through a series of molecular sieve columns. Approximately 5 cubic meters of air are passed through each sampler over a 7-day sampling period. From the HTO adsorbed on the first molecular sieve column, the concentration of ^{3}H in μCi/ml of recovered moisture and in μCi/ml of sampled air is determined by liquid-scintillation counting techniques. The ^{3}H, passing through the first column as free hydrogen (HT), is oxidized and collected on the last molecular sieve colu[illegible] From the concentration of ^{3}H in the moisture collected from the last [illegible] the ^{3}H (in μCi/ml of sampled air) existing as HT is determined.

Tab[illegible]marizes the results of this Network by listing the maximum, minimum, and average concentrations for ^{85}Kr, total Xe or ^{133}Xe, ^{3}H as CH_3T, ^{3}H as HTO, and ^{3}H as HT. The annual average concentrations for each station were calculated over the time period sampled assuming that all values less than the minimum detectable concentration (MDC) were equal to the MDC. All concentrations of ^{85}Kr, Xe or ^{133}Xe, ^{3}H as CH_3T, ^{3}H as HTO, and ^{3}H as HT are expressed in the same unit, μCi per ml of air. Since the ^{3}H concentration in air varies by factors of 15-20 while the concentration in water varies by factors up to about 4, the ^{3}H concentration in μCi/ml of atmospheric moisture is also given in the table as a more reliable indicator of when background concentrations of HTO are exceeded.

As shown by Table 4, the maximum and average ^{85}Kr levels at all stations were essentially the same. The concentrations of ^{3}H as HTO and as HT for the year were generally the same at all locations except for the on-NTS stations at BJY and Area 12, where the averages and ranges in concentrations were significantly higher than those for all other stations. The higher concentrations were generally associated with seepage from earlier NTS operations, such as the Sedan cratering test and Area 12 tunnel tests. The total of the average tritium concentrations ($HTO+HT+CH_3T$) for either of these on-NTS stations was less than 0.004% of the Concentration Guide for ^{3}H in air, which is 5 x 10^{-6} μCi/ml for an exposure to a radiation worker. Small quantities of ^{3}H in the form CH_3T were occasionally detected off-NTS. However, the concentration averages and ranges for samples collected at all off-NTS locations were generally the same. No definite correlation between CH_3T and NTS testing could be made.

Concentrations of radioxenon greater than the MDC were detected during the year at all on-NTS sampling locations and at two off-NTS locations. The radioxenon, identified as ^{133}Xe, was measured with a maximum concentration of 1.1 x 10^{-9} μCi/ml at the on-NTS station at Area 12. The applicable Concentration Guide (CG) for radiation workers is 1 x 10^{-5} μCi/ml. In the off-NTS ar[illegible] highest concentration was at Beatty with 1.4 x 10^{-10} μCi/ml, and t[illegible] highest concentration was at Diablo with 1.7 x 10^{-11} μCi/ml. At either [illegible] location the ^{133}Xe concentrations, when averaged over the total sampling times for the year, were less than 0.008% of the CG for this nuclide, which is 1 x 10^{-7} μCi/ml for a suitable sample of a population in an uncontrolled area.

DOSIMETRY NETWORK

The Dosimetry Network during 1974 consisted of 69 locations surrounding the Nevada Test Site which were monitored continuously with thermoluminescent dosimeters (TLD's). The locations of these stations, shown in Figure 8, are all within a 270-km radius of the center of the NTS and include both inhabited and uninhabited locations. Each Dosimetry Network station was routinely equipped with three EG&G Model TL-12 dosimeters which were exchanged on a quarterly basis. Within the general area covered by the dosimetry stations, between 45 and 52 cooperating off-site residents wore one or two dosimeters which were exchanged at the same time as the station dosimeters. For the last two quarters of 1974 (July - December), these off-site personnel were monitored using TLD-200 dosimeters and a Harshaw Model 2271 TLD reader system which is presently under evaluation.

The TL-12 dosimeter has an internal or self-exposure rate equivalent to 0.7 mR/d due to naturally occurring ^{40}K in the glass envelope and TLD binder. The TLD-200 dosimeters have no such self-exposure as they consist of indirectly-heated, monocrystalline calcium fluoride mounted on an aluminum card. The smallest net exposure which may be determined by either type of dosimeter is limited by the variations in the natural background radiation for a given station location. Experience has shown these variations to be significant from one monitoring period to another and much larger in magnitude than variations due to the precision of the dosimeters. Typically, however, the smallest net exposure observable for a 90-day monitoring period would be on the order of 15 - 45 mR in excess of background. The term "background," as used in this context, refers to naturally occurring radioactivity (including that in the dosimeter itself) plus a contribution from residual man-made fission products.

After appropriate corrections were made for the background exposure accumulated during shipment between the laboratory and the monitoring locations, the three dosimeter readings for each station were averaged. This average exposure value for each monitoring period and station was compared to values from the past three years to determine if the new value was within the range of previous background values for that station. Any values significantly greater than previous values would have led to calculations of net exposure, while values significantly less than previous values would have been examined to determine possible reader or handling errors producing invalid data. The results from each of the personnel dosimeters were compared to the background value of the nearest station to determine if a net exposure had occurred.

Table 5 lists the maximum, minimum, and average dose equivalent rate (mrem/d) measured at each station in the network during 1974. All doses are from environmental background. The dose equivalent rates were determined by dividing the total dose equivalent for each monitoring period by the number of days in the monitoring period (typically about 90 days per quarter for 1974). The average daily rate for the year was simply the average of the rates for the four quarters. The average annual dose for the year is the product of the average daily rate and 365 days. As shown by this table, the average annual station background doses ranged from 62 mrem to 160 mrem with a network average of 114 mrem. Both the range and the average values for 1974 have decreased slightly from the two previous years. This trend seems to be generally true for most network stations, but no explanation is offered for the trend at this time. Among the off-site residents who wore dosimeters continuously, no personnel doses greater than background were attributed to nuclear testing at NTS.

The whole-body gamma dose equivalent values measured by the Dosimetry Network generally agree well with those published by a special studies group in the Office of Radiation Programs, EPA.[8] This report estimates that gamma exposures from terrestrial and cosmic radiation for the United States range from 75 mrem to 225 mrem per person per annum, with a mean of 115 mrem/a. For the Dosimetry Network, the range was 60 mrem/a to 150 mrem/a with a mean of 110 mrem/a. If considered on a state-by-state basis, however, even better agreement is noted. For Nevada, the estimated average whole-body gamma dose equivalent from both terrestrial and cosmic radiation is 125 mrem/a, while the average from the Dosimetry Network was 115 mrem/a. Similarly the estimate for California is 90 mrem/a, compared to the Dosimetry Network average of 95 mrem/a for the California stations. For Utah, the estimate of 155 mrem/a does not compare well with the Dosimetry Network average of 100 mrem/a. However, the estimate includes a large component due to cosmic radiation which would be less predominant in the lower, southwestern portion of the State where the Dosimetry Network stations are located.

In the past years, there have occurred a number of unexplained high dosimeter readings which have been regarded as anomalous and were suspected of being caused by phenomena associated with the TLD material and not related to true gamma exposure. Out of the more than 1,000 dosimeters issued for the NTS Off-Site Dosimetry Network for 1974, only one unexplained high reading occurred. The dosimeter in question had a reading of 1800 mR and had been issued to an off-site resident in Beatty, Nevada, during the first quarter of 1974. A subsequent documented investigation revealed no explanation for the reading, but it was not believed to represent a true gamma dose to the individual.

A network of 30 stationary gamma rate recorders placed at selected air sampling locations was used to document gamma exposure rates at fixed locations (Figure 6). These recorders, designated as LSI's, use a 2.5- by 30.5-cm constant-current ionization chamber detector filled with methane, and operate on either 110 V a.c. or on a self-contained battery pack. They have a range of 0.004 mR/h to 40 mR/h with an accuracy of about ±10% of a reading above background. During this report period, no increase in exposure rates attributable to NTS operations was detected by the network of gamma rate recorders.

MILK SURVEILLANCE NETWORK

Milk is only one of the sources of dietary intake of environmental radioactivity. However, it is a very convenient indicator of the general population's intake of biologically significant radionuclide contaminants.

For this reason it is monitored on a routine basis. Few of the fission product radionuclides become incorporated into the milk due to the selective metabolism of the cow. However, those that are incorporated are very important from a radiological health standpoint. The amount transferred to milk is a very sensitive measure of their concentrations in the environment. The five most common fission product radionuclides which can occur in milk are $^{89-90}Sr$, ^{131}I, ^{137}Cs, and ^{140}Ba. A sixth radionuclide, ^{40}K, also occurs in milk at a reasonably constant concentration of about 1.2×10^{-6} µCi/ml. Since this is a naturally occurring radionuclide, it was not included in the analytical results summarized in this section.

The milk surveillance networks operated by the NERC-LV were the routine Milk Surveillance Network (MSN) and the Standby Milk Surveillance Network (SMSN). The MSN during 1974 (Figure 9) consisted of 25 different locations where 3.8-litre milk samples were collected from family cows, commercial pasteurized milk producers, Grade A raw milk intended for pasteurization, and Grade A raw milk for local consumption. In the event of a release of activity from the NTS, intensive sampling would have been conducted in the affected area within a 480-km radius of CP-1, NTS, to assess the radionuclide concentrations in milk, the radiation doses that could result from the ingestion of the milk, and the need for protective action. Milk supplies and producers beyond 480 km are sampled with the SMSN.

During 1974, 86 milk samples were collected from the MSN on a quarterly collection schedule. Milk could not usually be obtained at all locations at any one collection time. Cows not lactating, no one home, or no milk on the day field personnel arrived at the ranch were some of the reasons why some of the samples were not collected. During the year, milk sampling points also changed as cows were sold or were otherwise unavailable for regular milkings.

The SMSN consisted of about 175 Grade A milk processing plants in all States west of the Mississippi River, which could be requested by telephone to collect raw milk samples representing milk sheds supplying milk to the plants. Since there were no releases of radioactivity from the NTS or other test locations, this network was not activated except to request an occasional sample to check its readiness and reliability. No analytical results are reported here for the SMSN because the samples were not associated with any particular nuclear activity or installation.

Each milk sample was analyzed for gamma-emitters and $^{89-90}Sr$. Samples collected at six locations from the MSN were also analyzed for ^{3}H. Table 2 lists the general analytical procedures and detection limits for these analyses.

The analytical results of milk samples collected from the MSN during 1974 are summarized in Table 6. The maximum, minimum, and average concentrations of the ^{137}Cs, $^{89-90}Sr$, and ^{3}H in samples collected during the year are shown for each sampling location. No radionuclides from NTS operations were detected in any of the milk samples. Although ^{137}Cs and $^{89-90}Sr$ were observed in the samples, the concentrations of these radionuclides were similar to levels found in samples collected for the Pasteurized Milk Network (PMN). Therefore, they are attributed to world-wide fallout.

The PMN, sponsored jointly by the Environmental Protection Agency and the Public Health Service, consists of 63 sampling stations in the United States, one in Puerto Rico, and one in the Canal Zone. Sampling results are summarized by monthly averages, running 12-month averages, and a 12-month average for the whole network. Although the PMN results for the milk samples collected throughout CY 1974 are not complete, one can use the latest information on 12-month averages for comparison purposes since the period covers a full year of seasonal variations.

Shown below are the ranges in the 12-month averages for network stations and the network averages of ^{90}Sr and ^{137}Cs for both the PMN[9] and the MSN. For the PMN, concentrations which were equal to or less than the appropriate minimum detectable concentration (1-5 pCi/l for ^{89}Sr; 1-2 pCi/l for ^{90}Sr;

4-10 pCi/l for ^{137}Cs) were set equal to zero for averaging. For the MSN they were set equal to the MDC. As indicated by this comparison, the concentrations of these radionuclides in the area surrounding the NTS and other areas of North America are commensurate.

Radionuclide Concentrations
(10^{-9} μCi/ml)

Network	Period	Strontium-90: Range in 12-Month Station Averages	Strontium-90: 12-Month Network Average	Cesium-137: Range in 12-Month Station Averages	Cesium-137: 12-Month Network Average
PMN	June 1973-May 1974	0-9	5	0-9	2
MSN	January-December 1974	<1.0 - 4.5	<1.7	<10.0 - <10.0	<10.0

WATER SURVEILLANCE NETWORK

The Water Surveillance Network (WSN), operated in off-site areas around the NTS during 1974, consisted of 59 locations (Figures 10 and 11) where NERC-LV personnel collected 3.8-litre water samples. The samples were collected from community water supplies, wells, open and closed springs, streams, lakes, and ponds. If a release of radioactivity from NTS had occurred, special sampling within the affected area would have been conducted to determine radionuclide concentrations.

During 1974, 233 water samples were collected from these locations on a quarterly collection schedule. In some cases operational priorities, frozen sources, etc., prevented the sampling of each location every time.

All water samples from the WSN were analyzed by gamma spectrometry and counted for gross alpha and gross beta radioactivity. Network samples from approximately 13 locations west, south, and southeast of the NTS were also routinely analyzed for ^{3}H. For the purpose of identifying the source of the gross radioactivity in all network samples and monitoring for concentrations of strontium and plutonium in the environment, selected samples were given special analyses at least once during the year. For surface water samples, the special analyses included $^{89-90}$Sr, $^{238-239}$Pu, U, and ^{226}Ra. For drinking water samples, the analyses included $^{89-90}$Sr, U, and ^{226}Ra. Table 2 lists the general analytical procedures and detection limits for each analysis.

The analytical results of all samples were published in Radiation Data and Reports, a monthly periodical of the Environmental Protection Agency. For the purpose of this report, only the analytical results for $^{89-90}$Sr and Pu for the surface water samples and a summary of the ^{3}H results for all water samples are presented in Tables 7 and 8, respectively. No gamma-emitting fission products were detected in any of the samples by gamma spectrometry.

As shown by Table 7, no $^{89-90}$Sr was detected above the appropriate MDC for any of the samples. Levels of $^{238-239}$Pu at some locations fluctuated slightly above the detection limit. However, the levels above the MDC appeared to be random fluctuations. The range and average concentrations for the whole network are comparable to environmental levels, shown below, observed in samples collected by other agencies[10] in off-site regional areas during 1973.

Radioactivity Concentration (10^{-9} μCi/ml)

Location	No. of Samples	Pu Total			^{238}Pu			^{239}Pu		
		Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
LASL Albuquerque, [illegible]	19	---	---	---	0.009	0.12	0.04	0.007	0.82	0.14
Rocky Flats (Great Western Reservoir) Golden, CO	15	<0.01	0.31	<0.08	---	---	---	---	---	---
WSN (all locations) NTS, NV	12	---	---	---	<0.031	0.12	<0.037	<0.040	0.088	<0.052

Since levels of ^3H in surface water samples (Table 8) were consistent throughout the WSN and similar to levels observed by other agencies, shown below, all levels were attributed to world-wide fallout and natural sources.

Location	No. Samples	^3H Concentrations (10^{-9} μCi/ml) Min	Max	Avg
LASL Albuquerque, NM	19	<300	1300	600
LLL Livermore, CA	99	52	1100	236
WSN (all locations) NTS, NV	53	<210	1200	340

The levels of ^3H in samples collected at Vegas Wash and NERC-LV (Table 8) were generally higher than all other WSN locations. These two locations have a common source of water, the Colorado River, which has ^3H concentrations higher than other locations surrounding the NTS. This is due to the large fraction of flow resulting from surface runoff from watersheds of the Colorado River having higher rates of rainfall than the off-NTS area.

LONG-TERM HYDROLOGICAL MONITORING PROGRAM

During this report period, NERC-LV personnel continued the collection and analysis of water samples collected from wells, springs, and spring-fed surface water sources which are down-gradient of the ground water at the NTS and at off-NTS sites of underground nuclear detonations to monitor for any migration of test-related radionuclides into ground water. The water samples were collected from well heads or spring discharge points wherever possible. If pumps were not available, an electrical-mechanical water sampler capable of collecting 3-litre samples at depths to 1800 m was used.

NTS

For the NTS, attempts were made to sample 10 stations monthly and 18 stations semi-annually (Figures 12 and 13). Not all stations could be sampled with the desired frequency because of inclement weather conditions and inoperative pumps.

For each sampled location, samples of raw water, filtered water, and filtered and acidified water were collected. The raw water samples were analyzed for ^{3}H. Portions of the filtered and acidified samples were given radiochemical analyses. Portions of the filtered samples and the filtered and acidified samples received stable chemical analyses. Table 9 summarizes the criteria which were observed for analyzing the water samples. Each filter was also analyzed by gamma spectroscopy. Table 2 summarizes the analytical techniques used.

Tables 10 and 11 list the analytical results of all samples collected during this report period. Many of the 1973 monthly samples could not be analyzed in time for last year's report. Therefore, Table 12 is an updated listing of analytical results for these samples.

The only radionuclide unusual to well water that was detected was ^{3}H in NTS Wells C and C-1. The ^{3}H in these two wells was introduced as part of a tracer experiment. Both wells had concentrations which were less than 0.0001% of the Concentration Guide (CG) for a radiation worker.

Tables 10, 11, and 12 show concentrations of ^{90}Sr, ^{238}Pu, and ^{239}Pu that were above their respective MDC. These concentrations with two-sigma counting errors and percentages of CG's for individuals in an uncontrolled area are as follows:

Location	Radio-nuclide	Conc. ($10^{-9}\mu Ci/ml$)	% of Conc. Guide
NTS Well C	^{90}Sr	2.5 ± 1.3	0.83
NTS Well C (1973)	^{90}Sr	5.0 ± 1.8	1.7
NTS Well UE 19G-S	^{90}Sr	1.9 ± 1.6	0.63
NTS Well UE 5c	^{239}Pu	0.050 ± 0.030	0.001
Indian Springs Sewer Co. Inc. Well No. 1	^{238}Pu	0.018 ± 0.016	0.0003
Shoshone Spring	^{90}Sr	0.92 ± 0.91	0.31

The first two concentrations are considered to be anomalies. All other samples from each location during the year had concentrations below the MDC's or had concentrations with relatively large counting errors. The other concentrations listed above have error terms too large for one to say that the concentrations are real and not a result of statistical error.

Due to the absence of information on background levels of ^3H in deep wells, the ^3H concentrations measured by this program can only be compared to previous determinations for the same locations. Such a comparison for each location indicated that there are no significant trends in concentrations.

Other Test Sites

The annual collection and radiological analysis of water samples was continued for this program at all off-NTS sites of underground nuclear detonations except for Amchitka, Alaska, and Project Rio Blanco near Meeker, Colorado. The latter two sites are the responsibility of other agencies. The sites at which samples were collected are located near Rifle, Colorado (Project Rulison); at Tatum Dome, Mississippi (Project Dribble/Miracle Play); in Central Nevada (Faultless Event); near Fallon, Nevada (Project Shoal); in Rio Arriba County, New Mexico (Project Gasbuggy); and near Carlsbad, New Mexico (Project Gnome/Coach). Figures 14 through 20 identify the sampling locations, and Table 1 lists additional information on the location of each site and tests performed at these locations.

All samples were analyzed by the same criteria (Table 9) and procedures (Table 2) as samples for the NTS Program. The analytical results of all water samples collected during 1974 are summarized in Table 13. Table 14 lists the results of three samples collected in 1973 from the Project Shoal site which were not reported previously.

The only sample results showing radioactivity concentrations significantly over background levels were for Half Moon Creek Overflow (Project Dribble); for USGS Well No. 1 at Malaga, New Mexico (Project Gnome); for USGS Wells Nos. 4 and 8 at Malaga (Project Gnome); and for Well HT-2M at Tatum Salt Dome, Mississippi (Project Dribble). As explained in the 1973 report, the latter three wells, which are fenced, posted, and locked to prevent their use by unauthorized personnel, were contaminated by the injection of high concentrations of radioactivity for the purpose of waste disposal or radioactive tracer studies. Therefore, samples from the three contaminated wells are not used to monitor the movement of radionuclides from the underground tests.

The sample from Half Moon Creek Overflow, a surface water sample, had a ^3H concentration of 5.1×10^{-6} µCi/ml, whereas for previous years the ^3H concentrations have been 4.3×10^{-7} µCi/ml (1972) and 2.7×10^{-7} µCi/ml (1973). Since the high concentration for the year is only 0.17% of the Concentration Guide for individuals in an uncontrolled area, no further sampling was done prior to the next scheduled sampling in CY 1975. The concentrations of ^3H in all other surface waters were below 2.5×10^{-6} µCi/ml, a level considered from past experience to be the highest one would expect from atmospheric fallout.

The concentration of ^{90}Sr reported for the well sample collected at USGS Well No. 1, Malaga, New Mexico (Project Gnome), is considered to be a statistical error and not a valid value. The concentration with its two-sigma error term was 1.4×10^{-9} µCi/ml ± 0.85×10^{-9} µCi/ml.

The concentrations of ^{90}Sr measured in surface water samples were attributed to atmospheric fallout.

The ^{3}H concentrations measured in well samples were compared to the analytical results of samples collected previously at each location. No significant trends in concentrations were apparent.

WHOLE-BODY COUNTING

During 1974, the measurements of the body burdens of radioactivity in selected off-site residents who might have been exposed to radioactivity released from the NTS was continued. The whole-body counting facility was described in the 1973 report (NERC-LV-539-31, May 1974).

Ninety-five individuals from 14 locations were examined. These locations were Pahrump, Springdale, Beatty, Moapa, Caliente, Pioche, Nyala, Diablo, Goldfield, Lathrop Wells, Ely, Tonopah, Twin Springs, and Spring Meadows Farms, Nevada.

The minimum detectable concentration for ^{137}Cs was 5×10^{-9} µCi/g for a body weight of 70 kg and a 40-minute count. Each individual was also given a complete hematological examination and a thyroid profile; from each individual a urine sample was collected for ^{3}H and $^{238-239}Pu$ analyses.

From the results of whole-body counting, the fission product ^{137}Cs was detected above the detection limit in 25 individuals. The maximum, minimum, and average concentrations for this radionuclide were 4.1×10^{-8} µCi/g, 5.0×10^{-9} µCi/g, and 1.2×10^{-8} µCi/g body weight, respectively.

These concentrations are comparable to those reported by the Health Services Laboratory, Idaho National Engineering Laboratory, Energy Research and Development Administration.[11] This facility examines about 400 workers per annum at the National Reactor Testing Station, near Idaho Falls, Idaho.

For the past year, ^{137}Cs has not been measured above their detection limit of 0.002 μCi for a 10-minute count in any of the radiation workers except those known to be occupationally exposed. Based upon the 70 kg body weight of a standard man, this is equivalent to 3×10^{-8} μCi/g.

The only radioactivity detected from NTS operations was ^{133}Xe at Beatty and Diablo, Nevada. Based upon the sampling results for these locations and the dose calculations described in Appendix B, the whole-body doses to off-NTS residents were calculated. Since ^{133}Xe made up 94% of the total airborne radioactivity reported as released from the NTS during 1974, the contribution to the total dose received by off-NTS residents by all other reported radionuclides was considered negligible. No release of airborne ^{3}H was reported by ERDA/NV and no ^{3}H was detected off the NTS above its MDC. Therefore, no dose estimate from ^{3}H was calculated.

The largest population group within 80 km of the NTS Control Point (CP-1 in Figure 5) is located at Indian Springs, Nevada. Since a noble gas sampler is not operated at Indian Springs, a dose estimate for this location was also made, based upon the ^{133}Xe concentrations measured at Desert Rock, an on-NTS station which would normally intercept NTS night-time "drainage" winds headed for Indian Springs. The Desert Rock location is located close to the southern NTS boundary and serves as a fence-line monitor for that location. The following table summarizes the results of all calculations.

Location	Dose Calculated from Actual ^{133}Xe Concentrations (μrem)	Percent of Radiation Protection Standard	Dose Commitment Within 80 km (man-rem)
Beatty, NV	2	0.001	0.002
Indian Springs, NV	0.5	<0.0003	<0.001
Diablo, NV	0.1	0.00005	0*
		Total =	<0.003

*No people reside within an 80-km radius of CP-1 in this direction. Dose commitment at Diablo was 2×10^{-6} man-rem.

The dose estimates for all three locations were equal to or less than 0.001 percent of the radiation protection standard (Appendix A). In fact, the estimates were <0.002 percent of the dose one would receive from environmental background radiation, which ranges between 83-150 mrem/a for these locations.

These estimates are about 1/10 of more conservative dose estimates based upon atmospheric diffusion equations (Appendix B). Calculations with the latter, under the assumption that the total 663 Ci of ^{133}Xe from all sources during the year was released at a continuous rate over a period of several hours under atmospheric conditions which would maximize exposures, resulted in the following estimates:

Beatty	11 μrem
Indian Springs	11 μrem
Diablo	0.4 μrem

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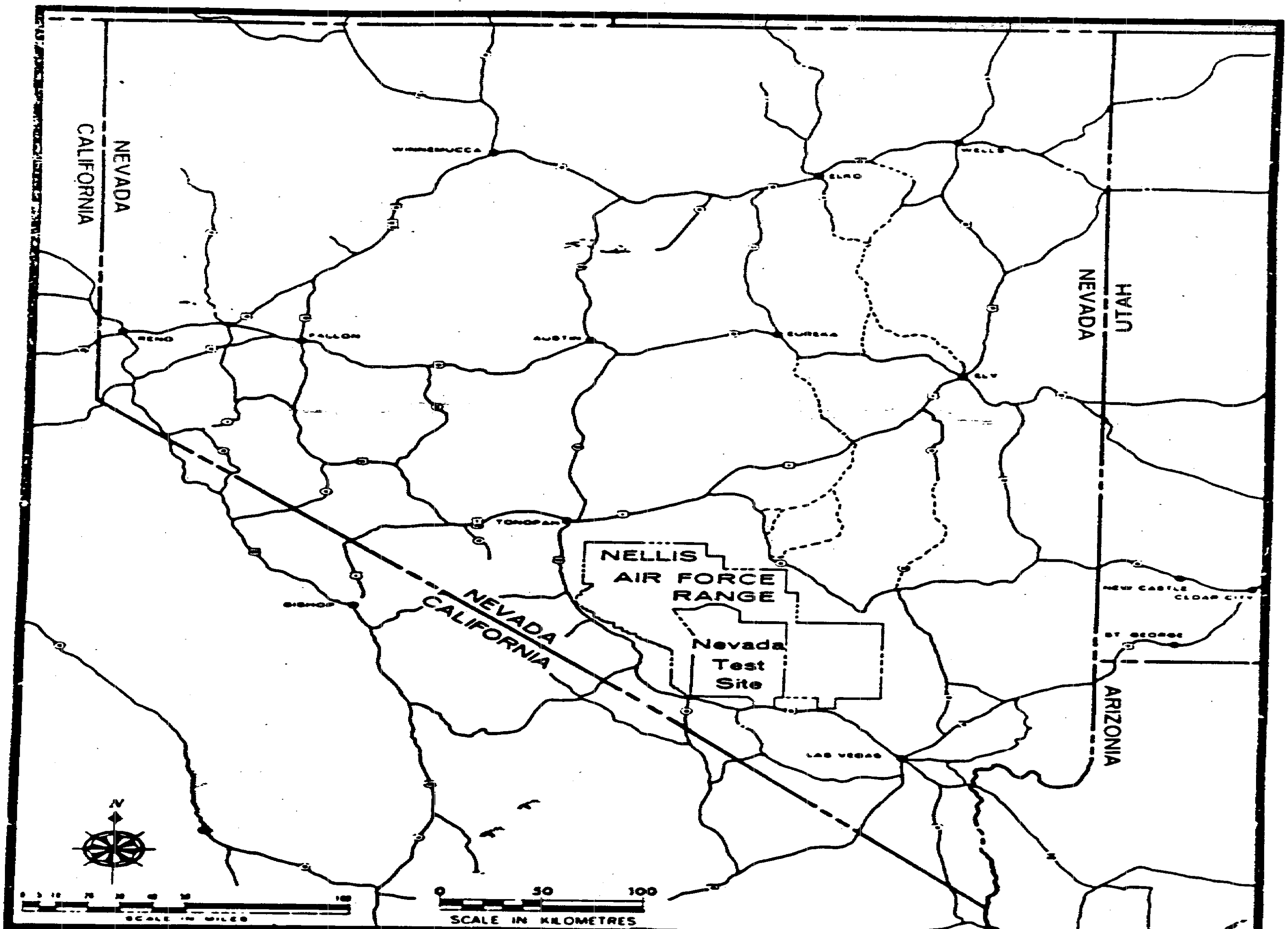


Figure 1. Nevada Test Site Location

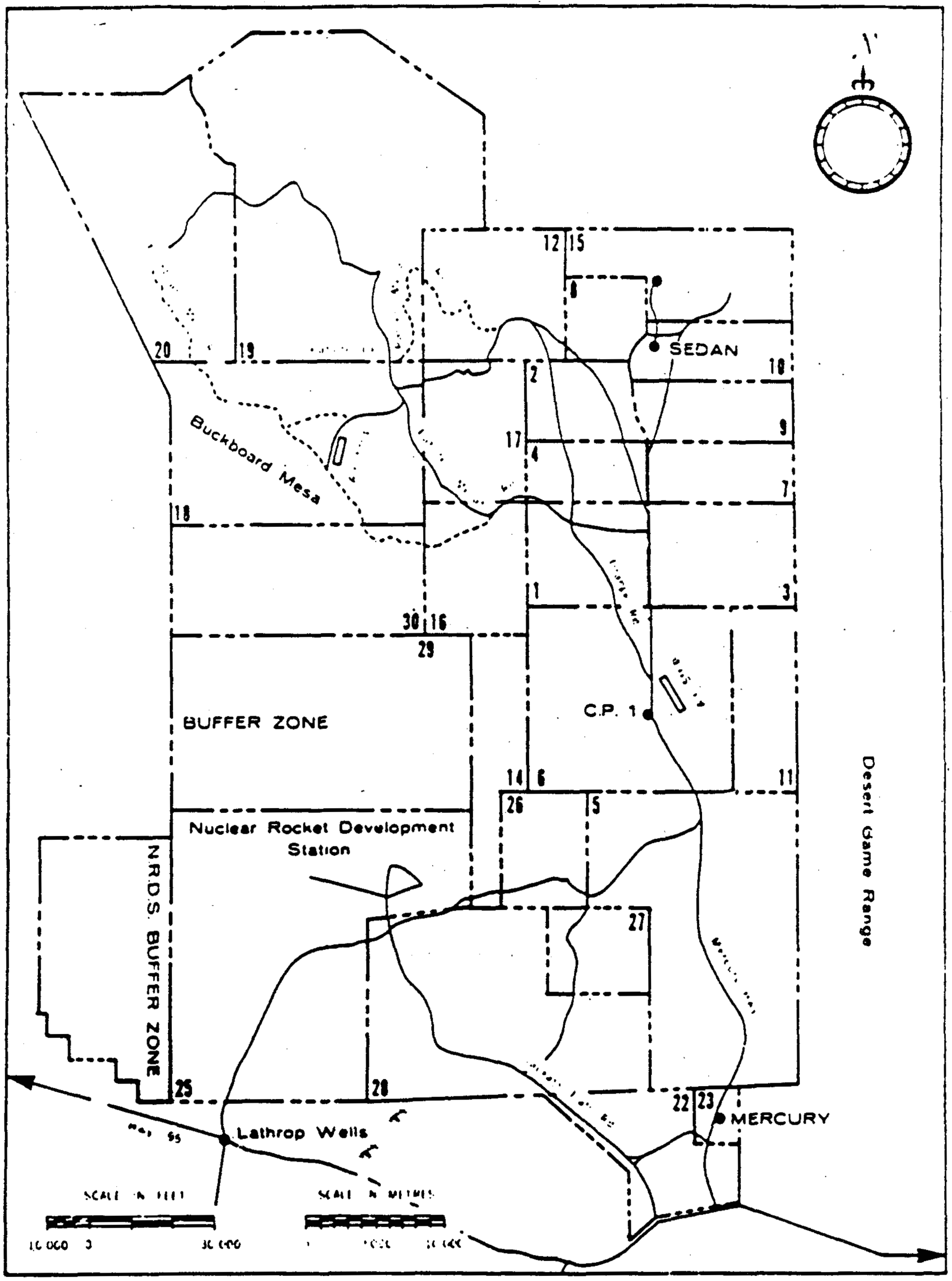


Figure 2. Nevada Test Site Road and Facility Map

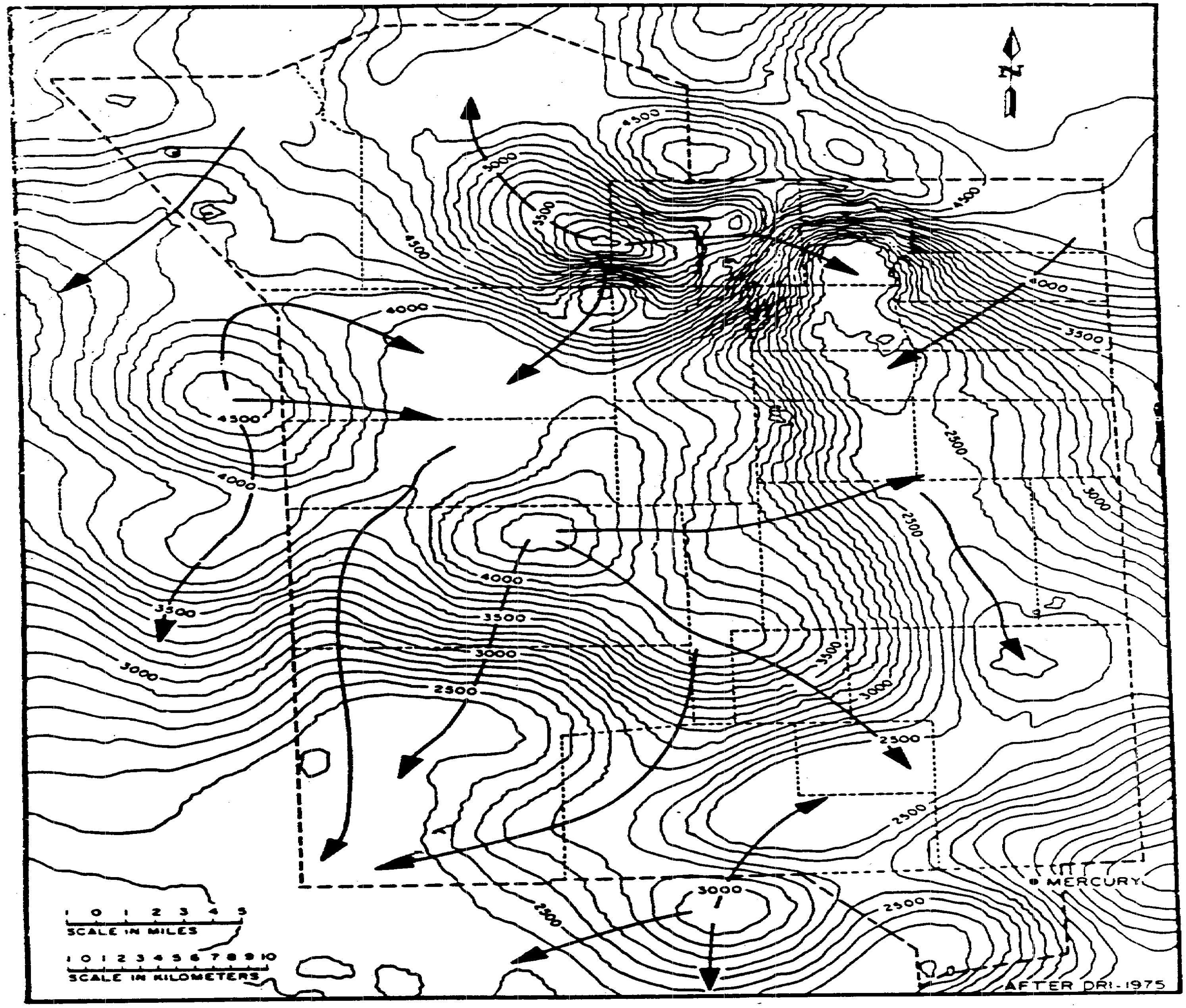


Figure 3. Ground Water Flow Systems - NTS

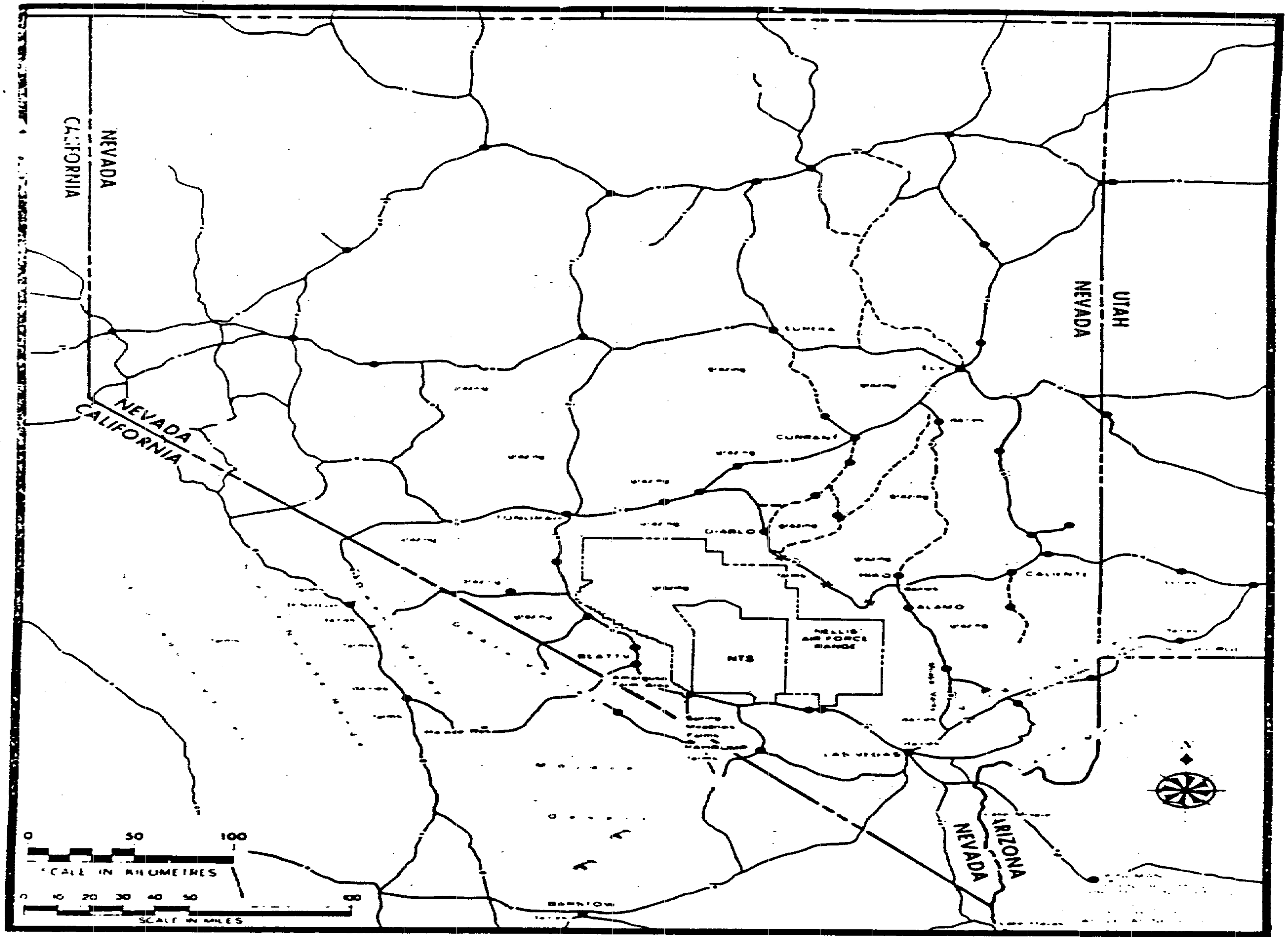


Figure 4. General Land Use, Nevada Test Site Vicinity

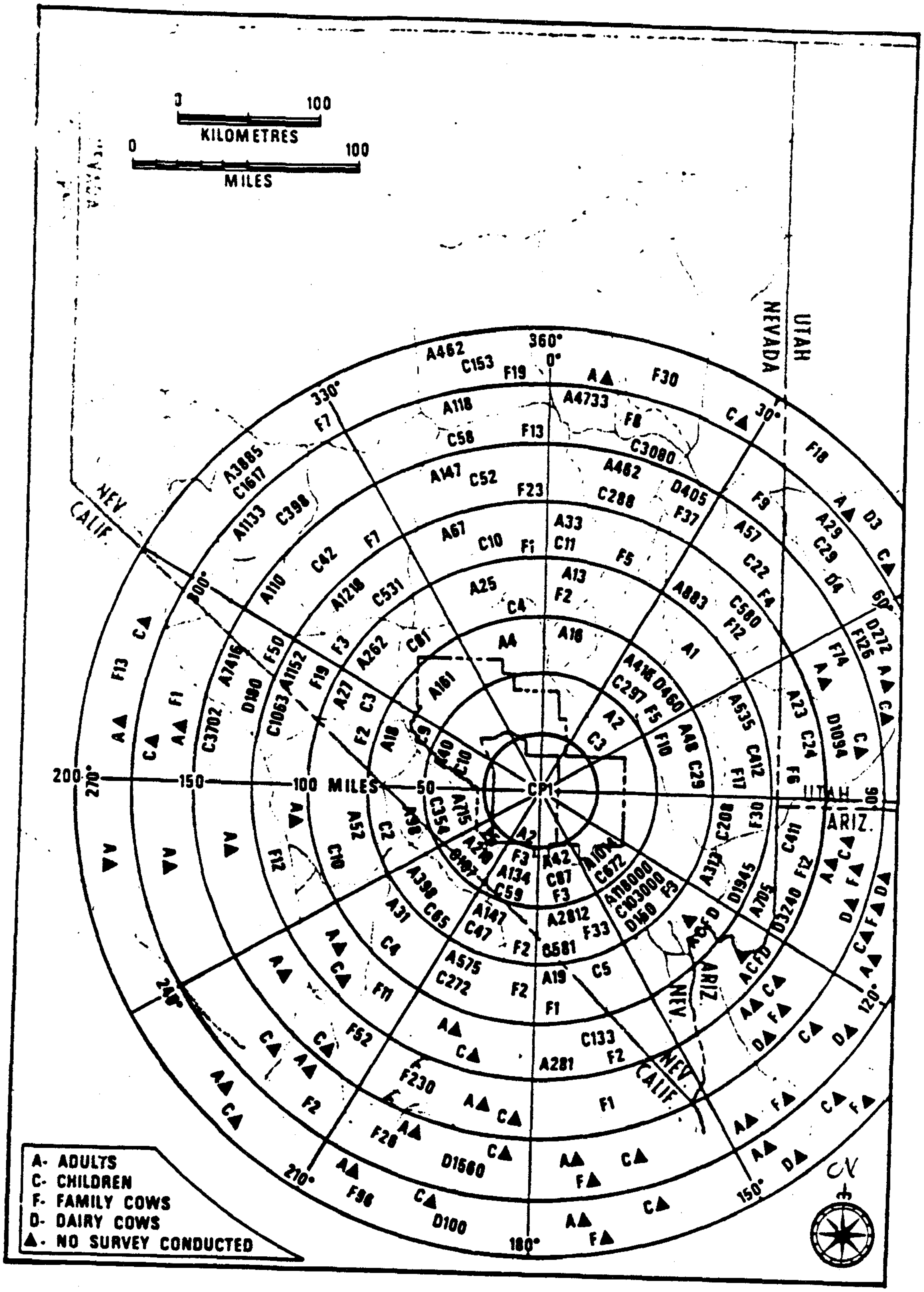


Figure 5. Population Distribution by Azimuth/Distance

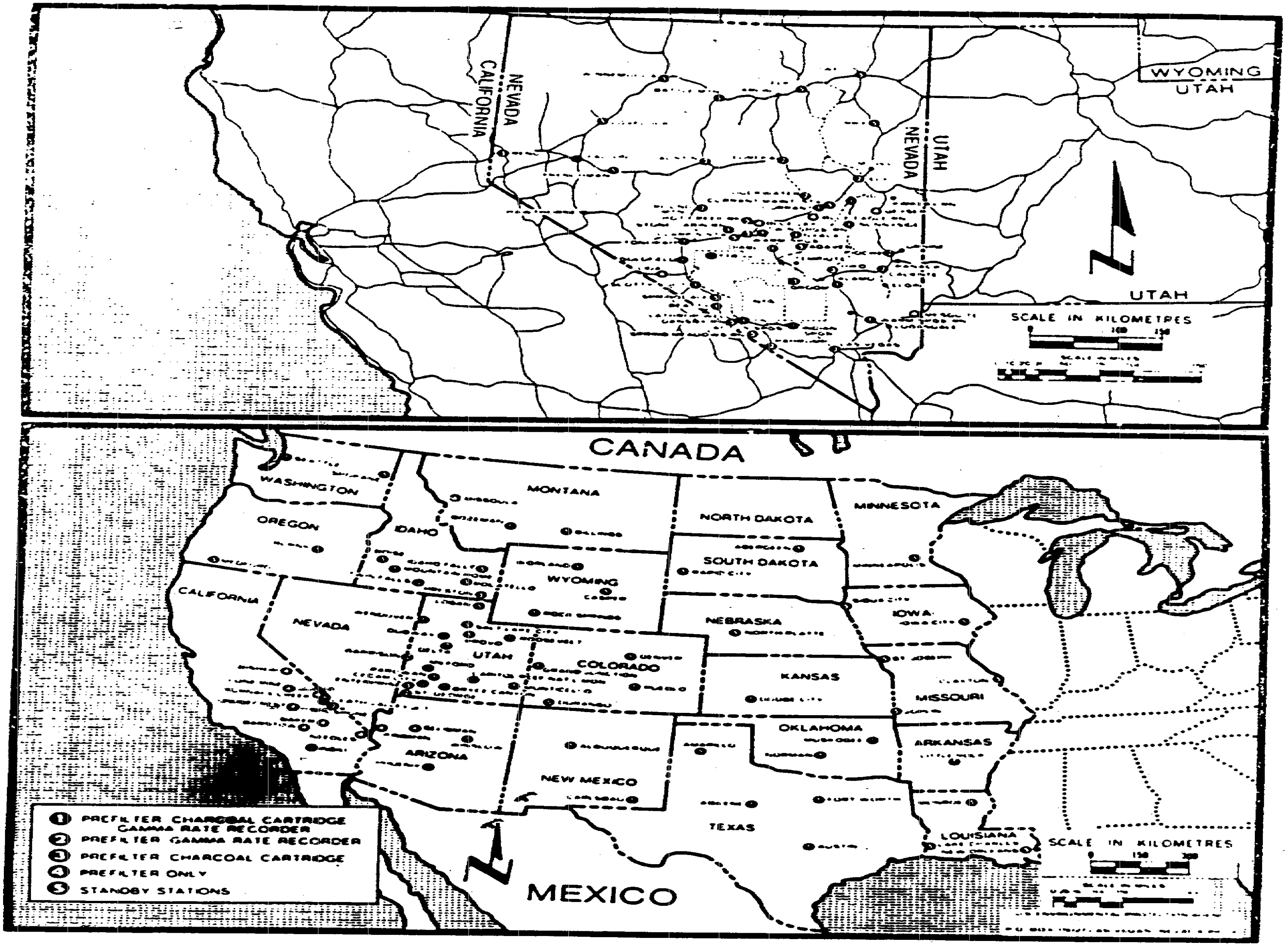


Figure 6. Air Surveillance Network

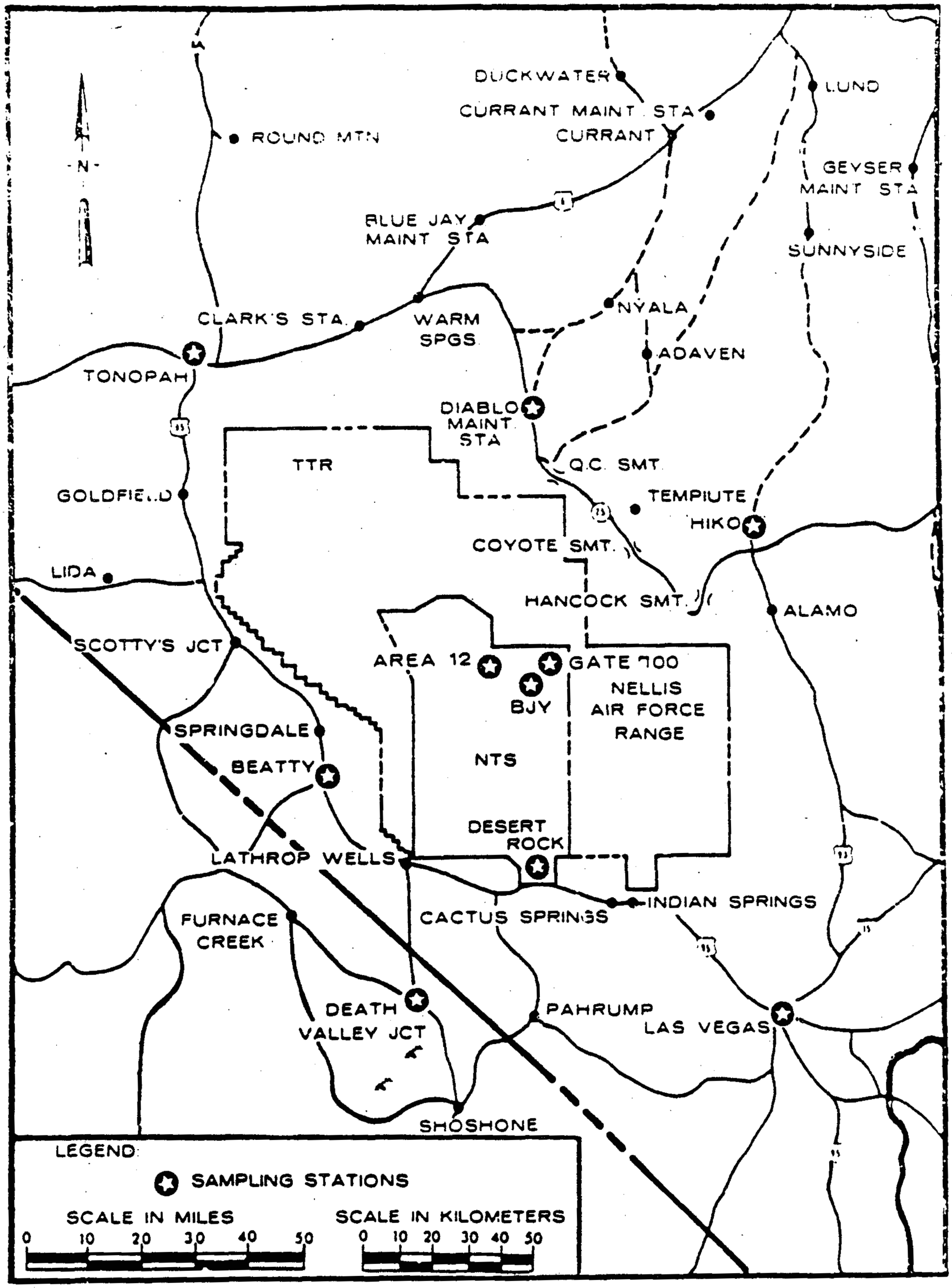


Figure 7. Noble Gas and Tritium Surveillance Network

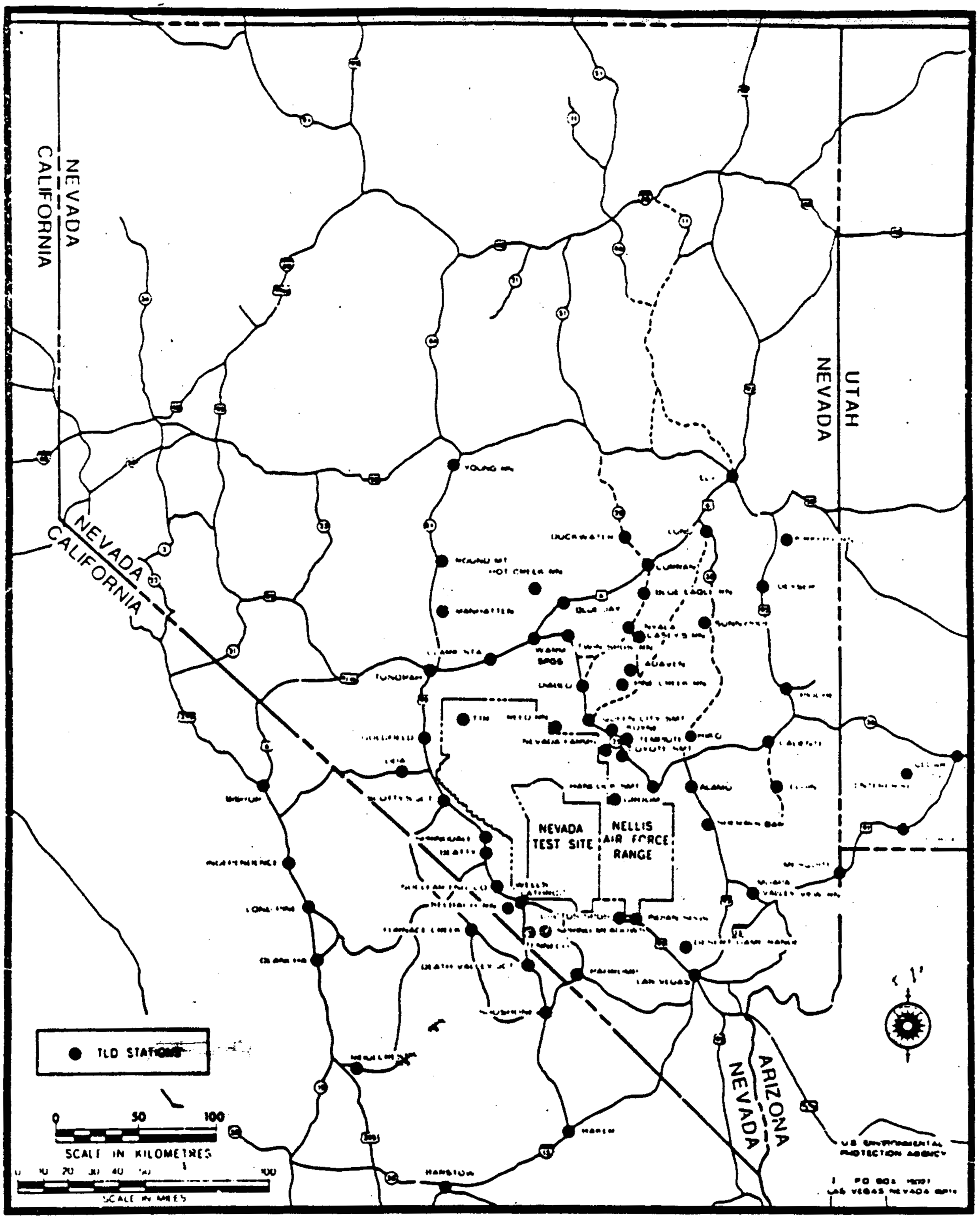


Figure 8. Dosimetry Network

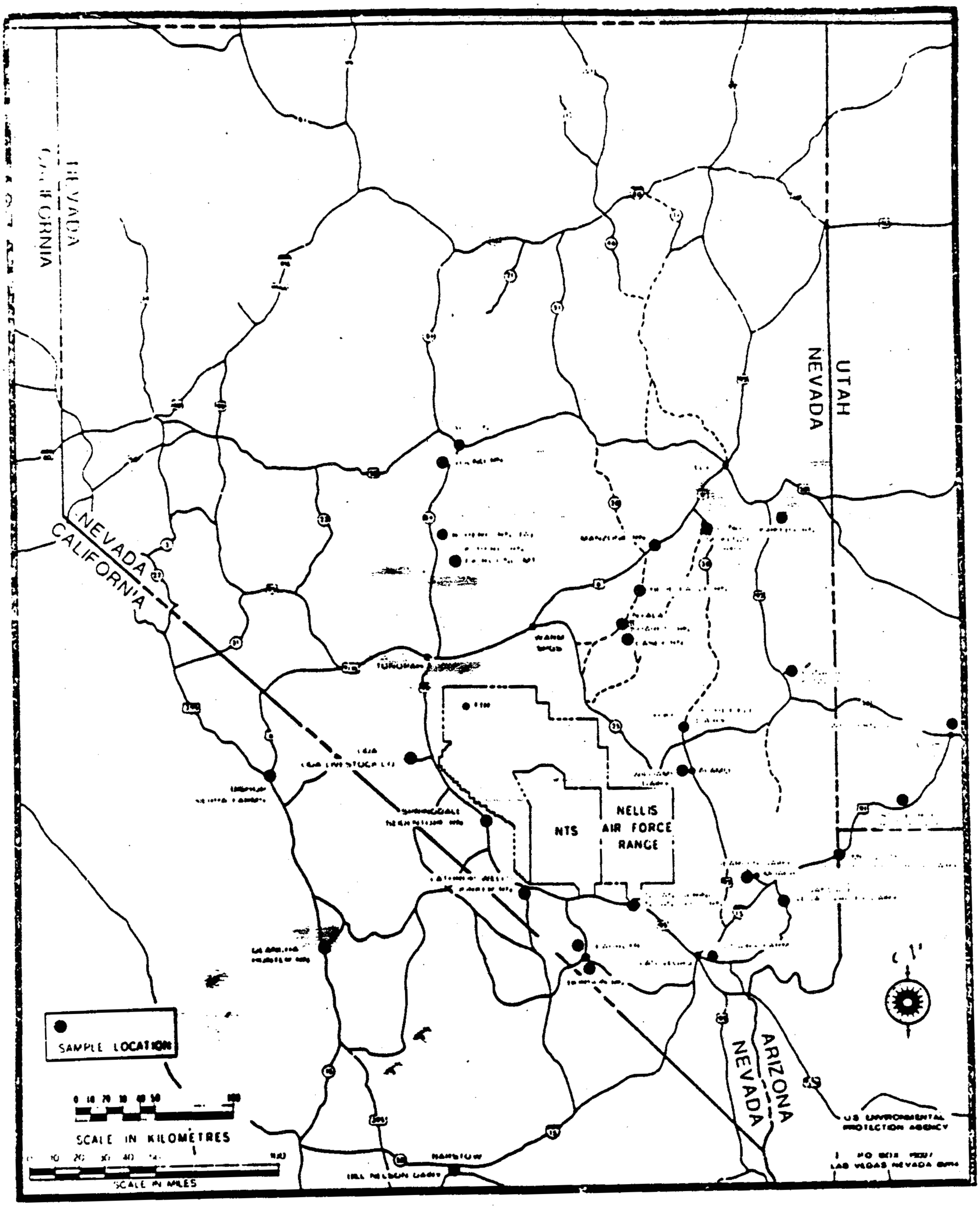


Figure 9. Milk Surveillance Network

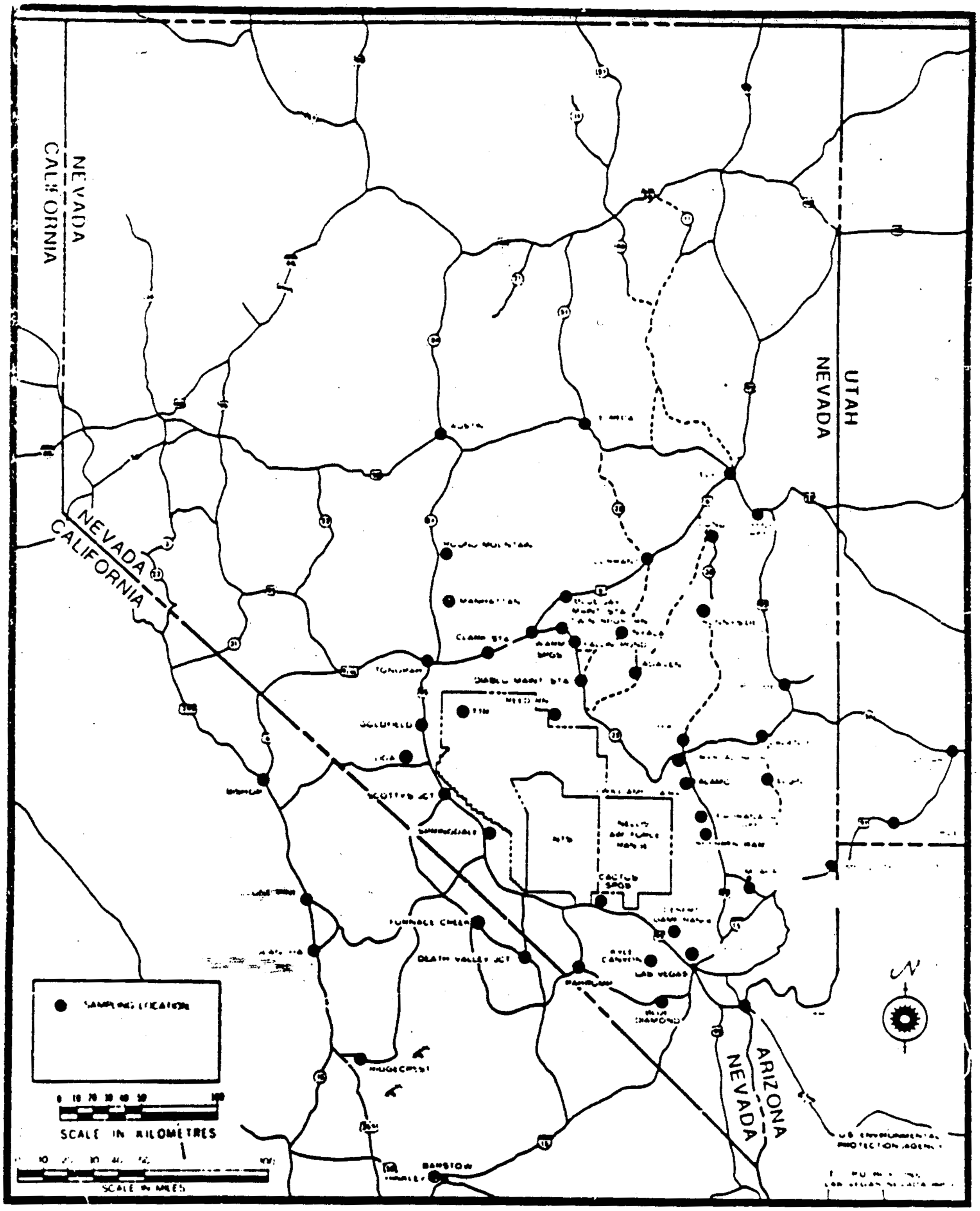


Figure 10. Water Surveillance Network

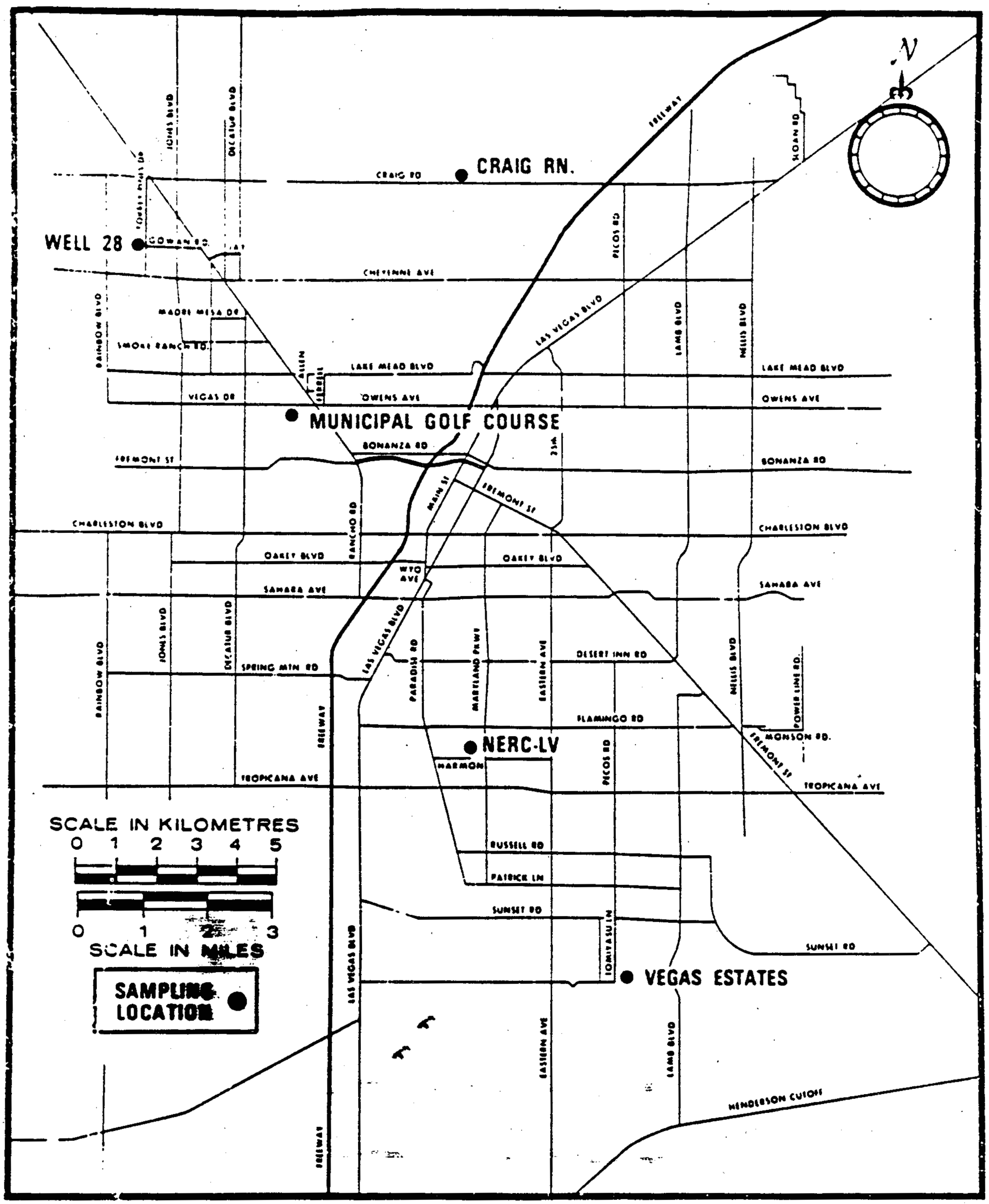


Figure 11. Water Surveillance Network, Las Vegas Valley

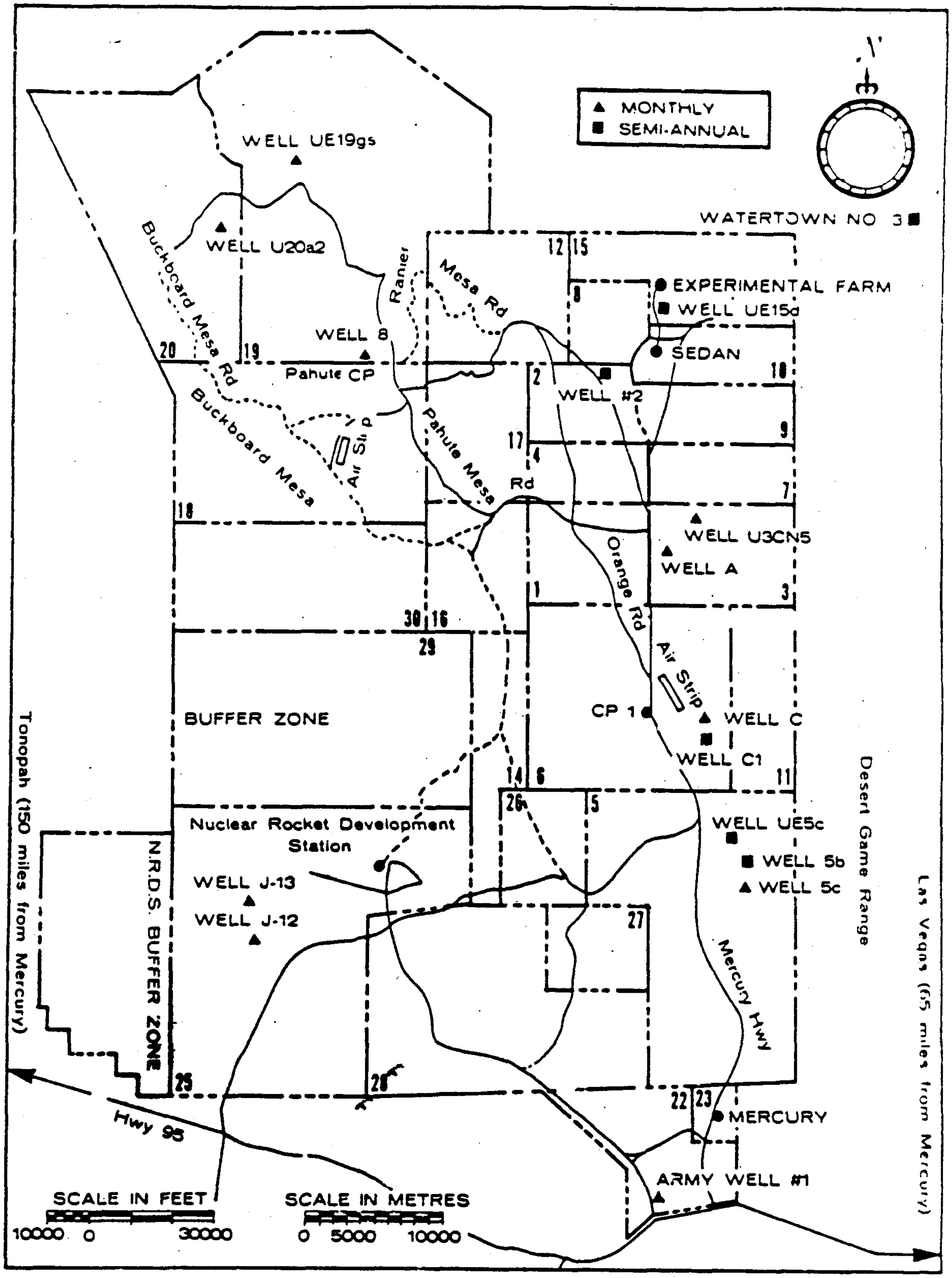


Figure 12. On-NTS Long-Term Hydrological Monitoring Program

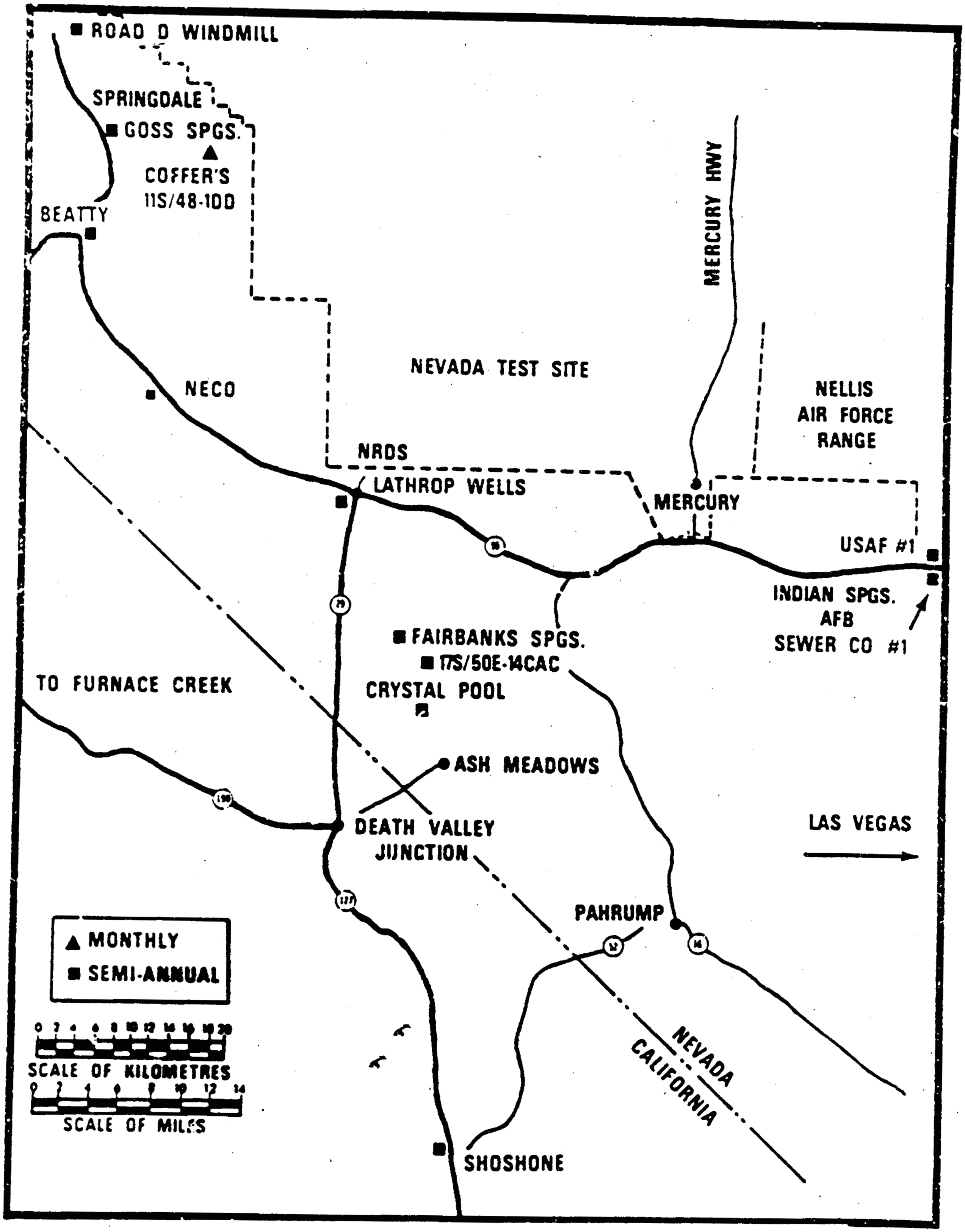
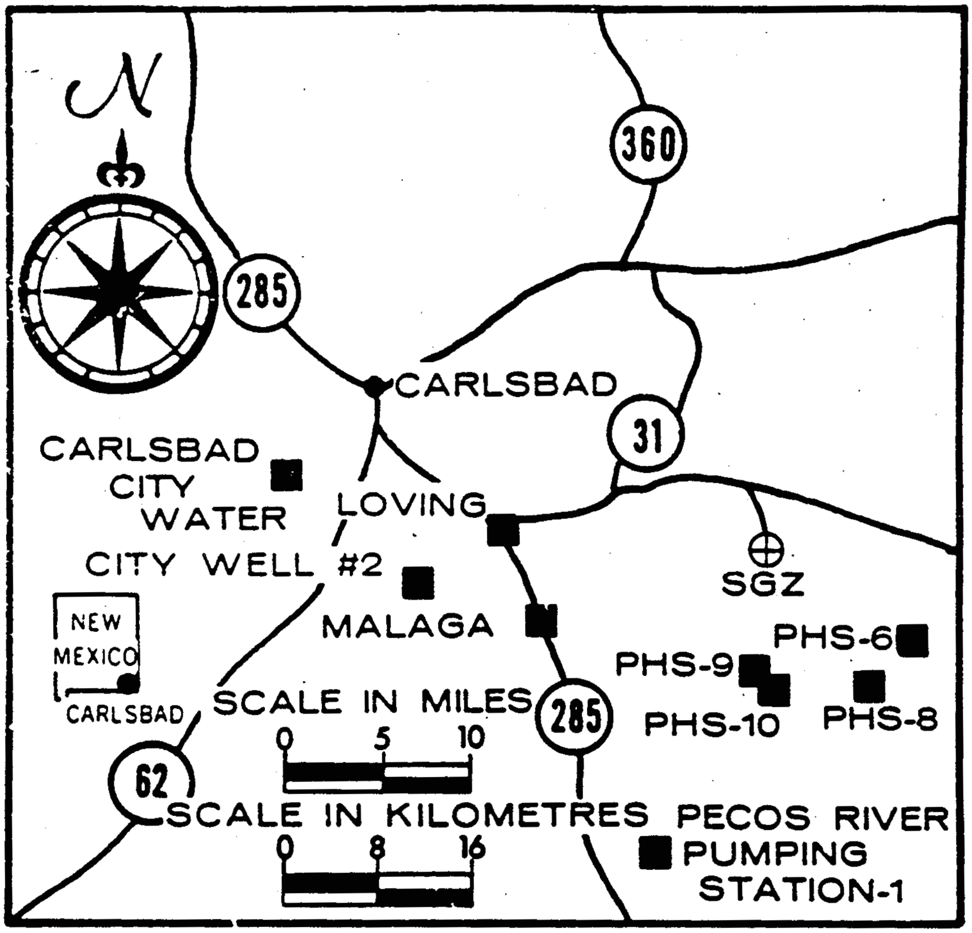
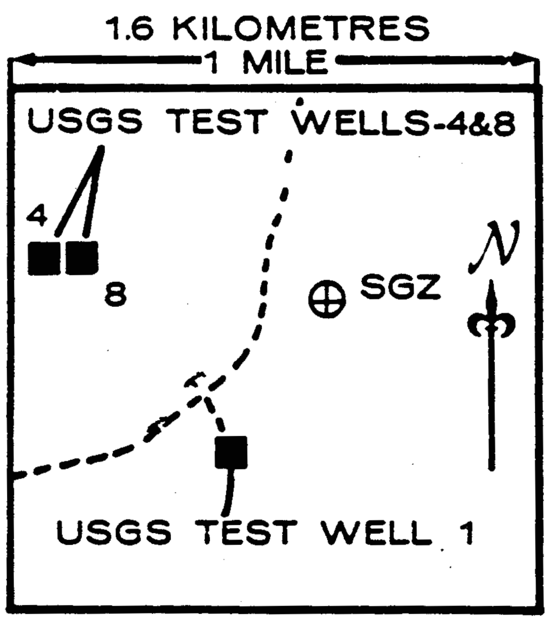


Figure 13. Off-NTS Long-Term Hydrological Monitoring Program



OFF-SITE SAMPLING LOCATIONS



ON-SITE SAMPLING LOCATION

Figure 14. Long-Term Hydrological Monitoring Locations, Carlsbad, NM, Project Gnome/Coach

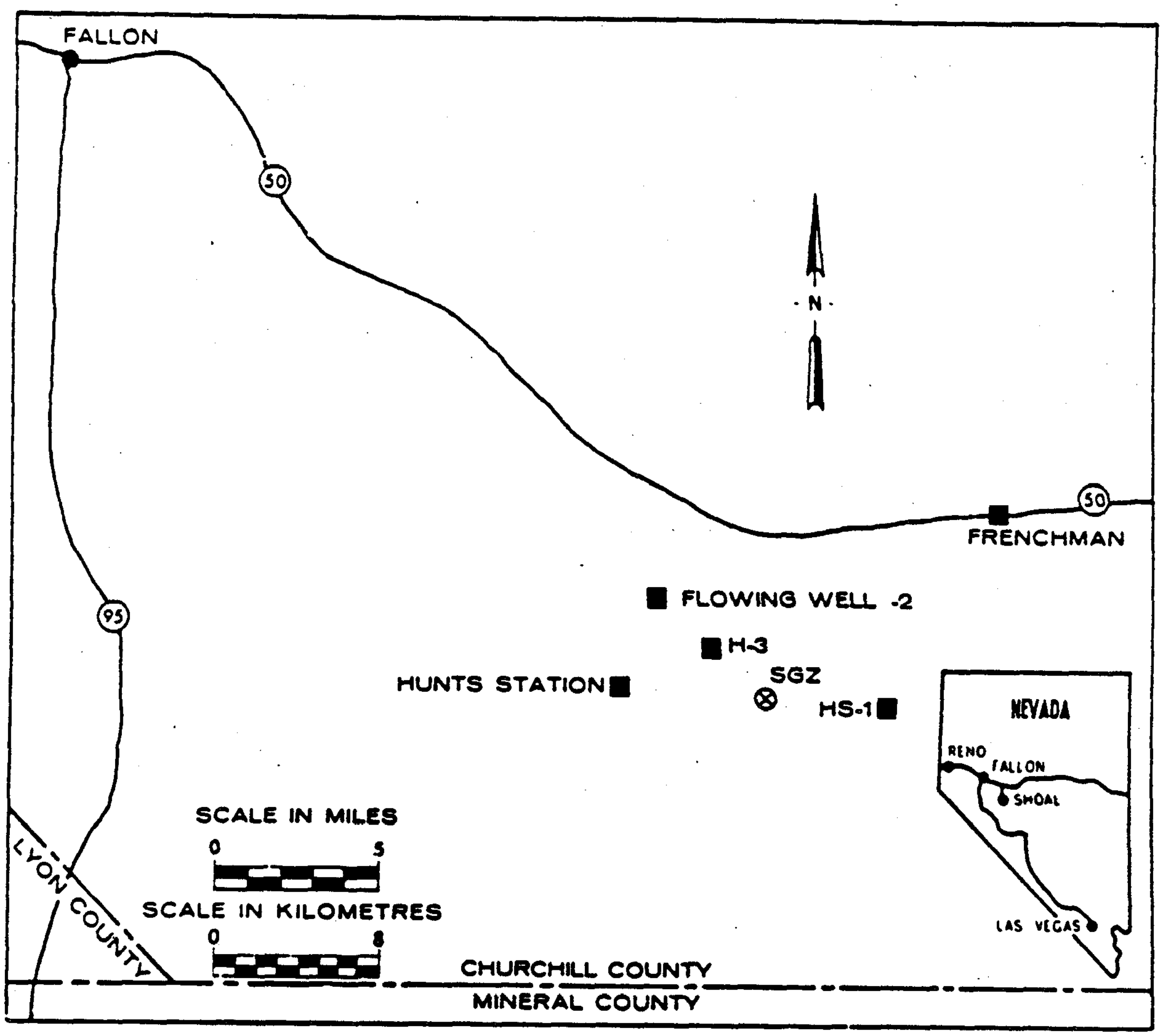


Figure 15. Long-Term Hydrological Monitoring Locations, Fallon, NV, Project Shoal

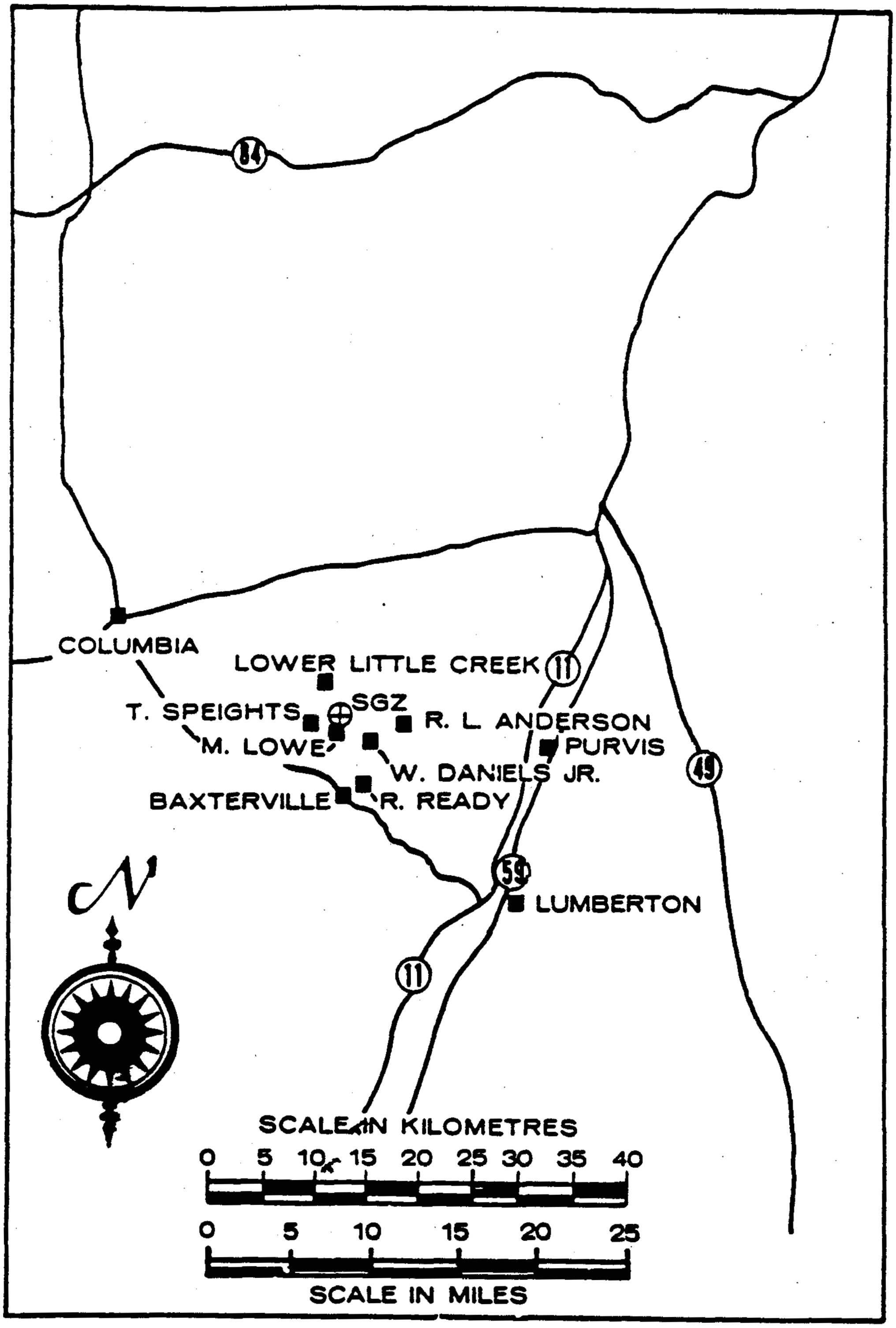


Figure 16. Long-Term Hydrological Monitoring Locations, Project Dribble/ Miracle Play (Vicinity of Tatum Salt Dome, MS)

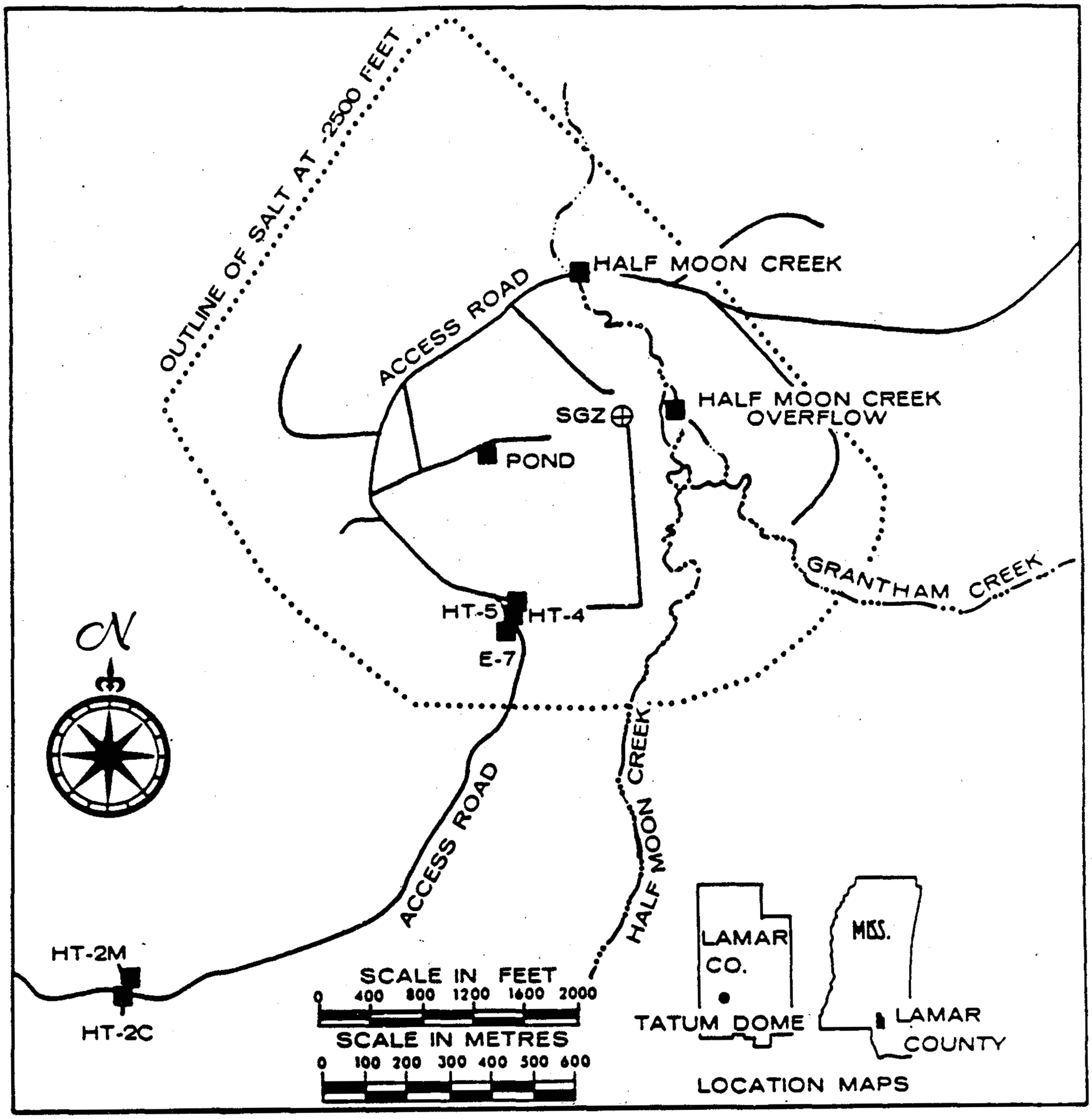


Figure 17. Long-Term Hydrological Monitoring Locations, Project Dribble/ Miracle Play (Tatum Salt Dome, MS)

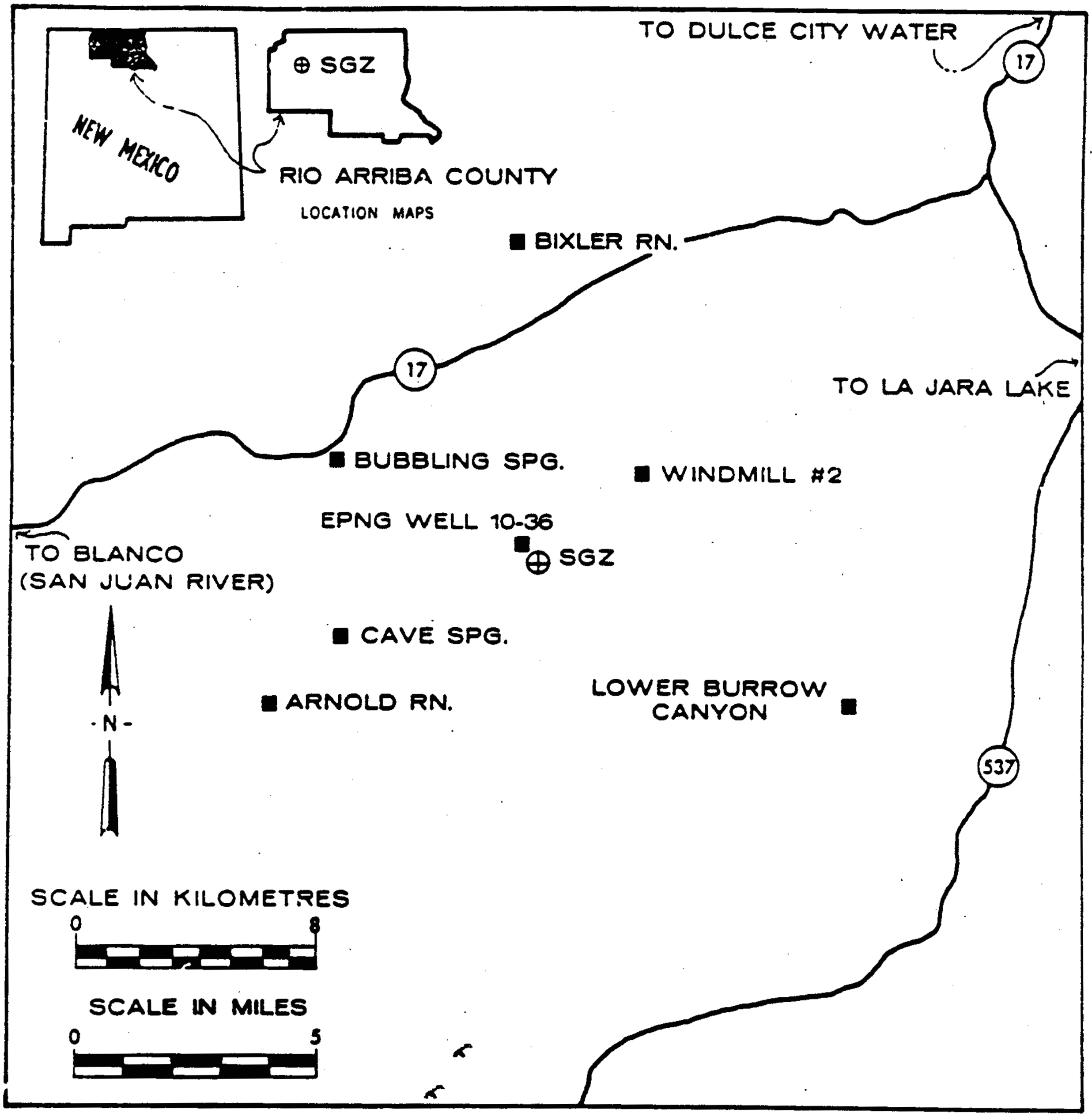


Figure 18. Long-Term Hydrological Monitoring Locations, Rio Arriba County, NM, Project Gasbuggy

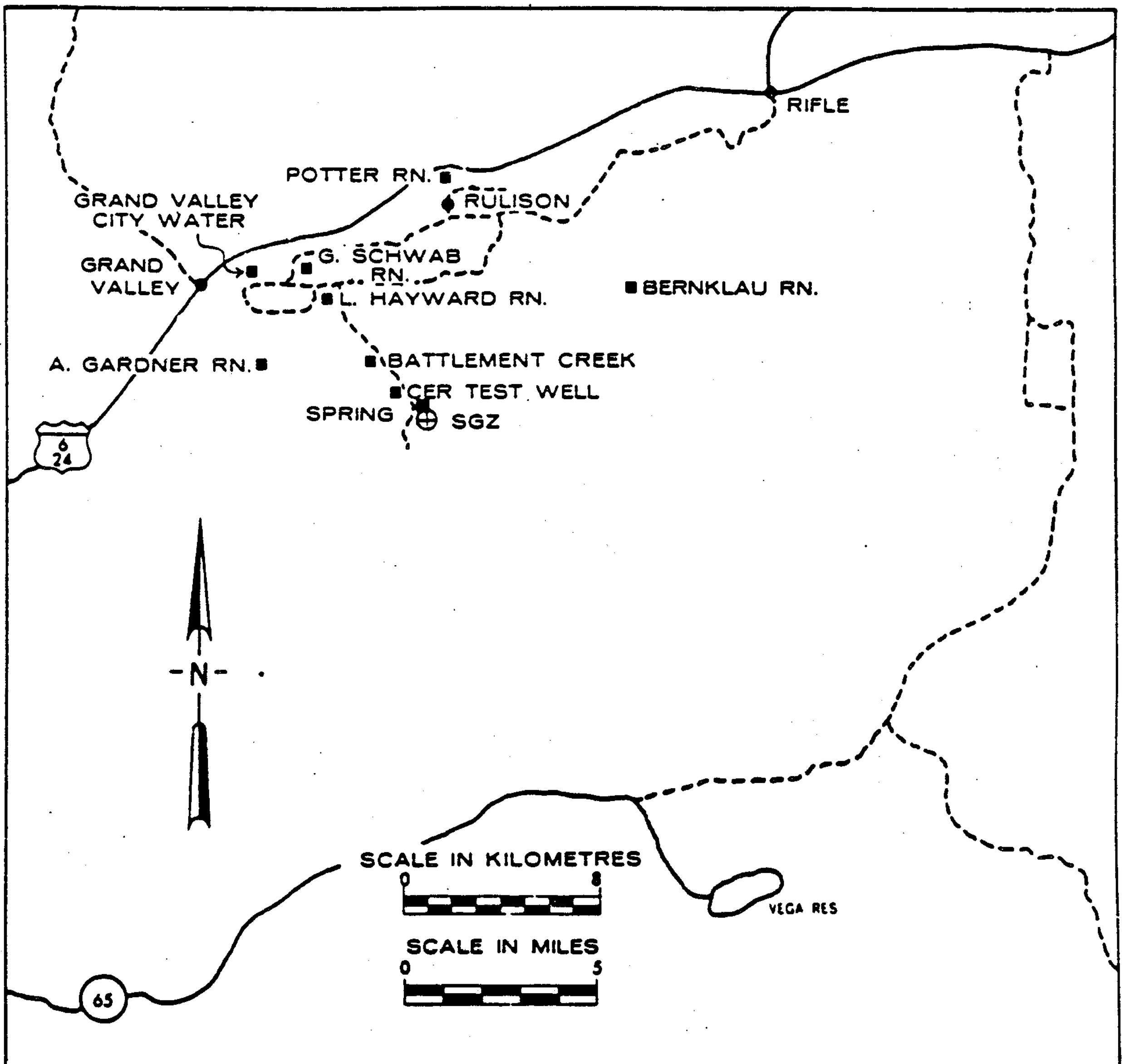


Figure 19. Long-Term Hydrological Monitoring Locations, Rulison, CO, Project Rulison

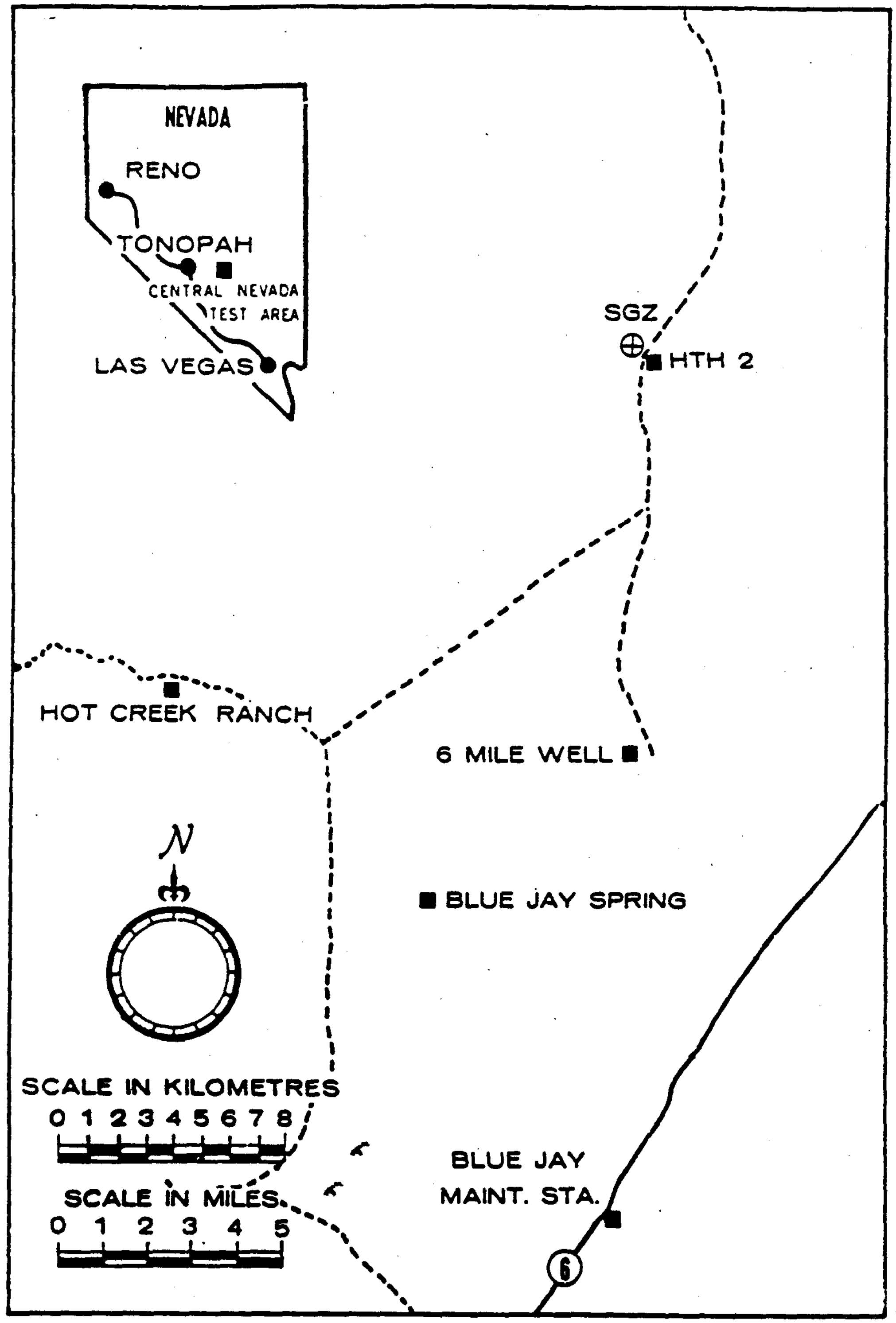


Figure 20. Long-Term Hydrological Monitoring Locations Central Nevada Test Area, Faultless Event

Table 1. Underground Testing Conducted Off the Nevada Test Site

Name of Test, Operation or Project	Date	Location	Yield[d]	Depth m (ft)	Purpose of the Event[d,e]
Project Gnome/ Coach[a]	12/10/61	48 km (30 mi) SE of Carlsbad, NM	3.1 kt[f]	360 (1184)	Multi-purpose experiment.
Project Shoal[b]	10/26/63	45 km (28 mi) SE of Fallon, NV	~12 kt	366 (1200)	Nuclear test detection research experiment.
Project Dribble[b] (Salmon Event)	10/22/64	34 km (21 mi) SW of Hattiesburg, MI	5.3 kt	823 (2700)	Nuclear test detection research experiment.
Operation Long Shot[b]	10/29/65	Amchitka Island, AK	~80 kt	716 (2350)	DOD nuclear test detection experiment.
Project Dribble[b] (Sterling Event)	12/3/66	34 km (21 mi) SW of Hattiesburg, MI	380 t	823 (2700)	Nuclear test detection research experiment.
Project Gasbuggy[a]	12/10/67	88 km (55 mi) E of Farmington, NM	29 kt	1292 (4240)	Joint Government-Industry gas stimulation experiment.
Faultless Event[c]	1/19/68	Central Nevada Test Area 96 km (60 mi) E of Tonopah, NV	200 kt-1 Mt	914 (3000)	Calibration test.
Project Miracle Play (Diode Tube)[b]	2/2/69	34 km (21 mi) SW of Hattiesburg, MI	Non-nuclear explosion	823 (2700)	Detonated in Salmon/ Sterling cavity. Seismic studies.
Project Rulison[a]	9/10/69	19 km (12 mi) SW of Rifle, CO	40 kt	2568 (8425)	Gas stimulation experiment.
Operation Milrow[c]	10/2/69	Amchitka Island, AK	~1 Mt	1219 (4000)	Calibration test.
Project Miracle Play (Humid Water)[b]	4/19/70	34 km (21 mi) SW of Hattiesburg, MI	Non-nuclear explosion	823 (2700)	Detonated in Salmon/ Sterling cavity. Seismic studies.
Operation Cannikin[c]	11/6/71	Amchitka Island, AK	<5 Mt	1829 (6000)	Test of warhead for Spartan missle

Table 1. (continued)

Name of Test, Operation or Project	Date	Location	Yield[d]	Depth m (ft)	Purpose of the Event[d,e]
Project Rio Blanco[a]	5/17/73	48 km (30 mi) SW of Meeker, CO	3x30 kt	1780 to 2040 (5840 to 6690)	Gas stimulation experiment.

[a] Plowshare events

[b] Vela Uniform Events

[c] Weapons tests

[d] Information from "Revised Nuclear Test Statistics," distributed on January 15, 1973, by Henry G. Vermillion, Director, Office of Information Services, U.S. Atomic Energy Commission, Las Vegas, Nevada.

[e] News release AL-62-50, AEC Albuquerque Operations Office, Albuquerque, New Mexico. December 1, 1961.

[f] "The Effects of Nuclear Weapons" Rev. Ed. 1964.

Table 2. Summary of Analytical Procedures

Type of Analysis	Analytical Equipment	Counting Period (Min)	Analytical Procedures	Sample Size (Litre)	Detection Limit[b]
Gamma Spectroscopy[a]	Gamma spectrometer with 10-cm-thick by 10-cm-diameter NaI (Tl-activated) crystal with input to 200 channels (0-2 MeV) of 400-channel, pulse-height analyzer.	40-100 for milk and water samples; 10-40 for air filters or charcoal cartridges; 100 for Long-Term Hydro. Water filters.	Radionuclide concentrations quantitated from gamma spectrometer data by computer using the matrix technique.	0.4-3.5 for routine milk and water samples; 350m^3 for air filter samples; 7.3 litre for Long-Term Hydro. Water through filter.	For routine milk and water generally ≈ 1×10^{-8} µCi/ml for most common fallout radionuclides in a simple spectrum. For air filters, ≈ 1×10^{-13} µCi/ml. For Long-Term Hydro. suspended solids, ≈ 3.0×10^{-9} µCi/ml.
$^{89-90}Sr$[c]	Low-background thin-window, gas-flow proportional counter with a 5.7-cm diameter window (80 µg/cm^2).	50	Chemical separation by ion exchange. Separated sample counted successively; activity calculated by simultaneous equations.	1.0	^{89}Sr = 2×10^{-9} µCi/ml ^{90}Sr = 1×10^{-9} µCi/ml
^{3}H[c]	Automatic liquid scintillation counter with output printer.	200	Sample prepared by distillation.	0.005	≈2.2×10^{-7} µCi/ml
^{3}H Enrichment (Long-Term Hydrological Samples)[c]	Automatic scintillation counter with output printer.	200	Sample concentrated by electrolysis followed by distillation.	0.25	≈6.0×10^{-9} µCi/ml
$^{238,239}Pu$ $^{234,235,238}U$[c]	Alpha spectrometer with 45 mm^2, 300-µm depletion depth silicon surface barrier detectors operated in vacuum chambers.	1000 - 1400	Sample is digested with acid, separated by ion exchange, electroplated on stainless steel planchet and counted by alpha spectrometer.	1	^{238}Pu = 4×10^{-11} µCi/ml ^{239}Pu, ^{234}U, ^{235}U, ^{238}U = 2×10^{-11} µCi/ml

Table 2. (continued)

Type of Analysis	Analytical Equipment	Counting Period (Min)	Analytical Procedures	Sample Size (Litre)	Detection Limit[b]
^{226}Ra[c]	Single channel analyzer coupled to P.M. tube detector.	30	Precipitated with Ba, converted to chloride. Stored for 30 days for ^{222}Ra ^{226}Ra to equilibrate. Radon gas pumped into scintillation cell for alpha scintillation counting.	1.5	$\approx 1 \times 10^{-10}$ µCi/ml
Gross alpha Gross beta in liquid samples[c]	Low-background thin-window, gas-flow proportional counter with a 5.7-cm-diameter window (80 µg/cm^2)	50	Sample evaporated; residue counted.	0.2	$\alpha = 3 \times 10^{-9}$ µCi/ml $\beta = 2 \times 10^{-9}$ µCi/ml
Gross beta on air filters[a]	Low-level end window, gas flow proportional counter with a 12.7-cm-diameter window (100 mg/cm^2)	5	Filters counted upon receipt and at 5 and 12 days after collection; last two counts used to extrapolate concentration to mid-collection time assuming $T^{-1.2}$ decay or using experimentally derived decay.	10-cm diameter glass fiber filter; sample collected from ≈ 350 m^3.	$\approx 6 \times 10^{-14}$ µCi/ml

Table 2. (continued)

Type of Analysis	Analytical Equipment	Counting Period (Min)	Analytical Procedures	Sample Size (Litre)	Detection Limit[b]
^{85}Kr Xe CH_3T[c]	Automatic liquid scintillation counter with output printer.	200	Physical separation by gas chromatography; dissolved in toluene "cocktail" for counting.	400-1000	$^{85}Kr = 2x10^{-12}$ µCi/ml Xe = $2x10^{-12}$ µCi/ml $CH_3T = 2x10^{-12}$ µCi/ml

[a]Lem, P. N. and Snelling, R. N. "Southwestern Radiological Health Laboratory Data Analysis and Procedures Manual," SWRHL-21. Southwestern Radiological Health Laboratory, Environmental Protection Agency, Las Vegas, NV. March 1971.

[b]The detection limit for all samples other than air is defined as that radioactivity which equals the 2-sigma counting error. The detection limit for gross beta radioactivity on air filters is defined as that concentration which produces a ±25% counting deviation at the 95% confidence level. The detection limit for gamma spectroscopy analyses on air filters is based upon that quantity of radioactivity which can be recognized in a gamma spectrum.

[c]Johns, F. B. "Handbook of Radiochemical Analytical Methods," EPA 680/4-75-001. Environmental Protection Agency, NERC-LV, Las Vegas, NV. February 1975.

Table 3. 1974 Summary of Analytical Results for the Air Surveillance Network

Sampling Location	No. Days Sampled[a]	Type of Radioactivity	Radioactivity Concentration (10^{-12} μCi/ml) C_{Max}	C_{Min}	C_{Avg}[b]
Kingman, AZ	3.0	^{7}Be	0.17	0.17	0.0014
	50.0	^{95}Zr	1.2	0.058	0.042
	22.0	^{103}Ru	0.10	0.036	0.0040
	26.0	^{106}Ru	0.59	0.020	0.023
	19.0	^{141}Ce	0.12	0.041	0.0039
	22.0	^{144}Ce	0.54	0.18	0.022
Seligman, AZ	17.0	^{95}Zr	0.46	0.22	0.016
	11.0	^{103}Ru	0.072	0.053	0.0018
	6.0	^{106}Ru	0.36	0.34	0.0058
	11.0	^{141}Ce	0.086	0.048	0.0020
	6.0	^{144}Ce	0.50	0.36	0.0071
Death Valley Jct., CA	41.0	^{95}Zr	0.43	0.088	0.038
	16.0	^{103}Ru	0.098	0.060	0.0035
	25.0	^{106}Ru	0.60	0.32	0.031
	16.0	^{141}Ce	0.081	0.060	0.0035
	22.0	^{144}Ce	0.59	0.31	0.027
Furnace Creek, CA	39.0	^{95}Zr	0.52	0.099	0.032
	11.0	^{103}Ru	0.12	0.046	0.0022
	28.0	^{106}Ru	0.64	0.25	0.033
	3.0	^{140}Ba	0.050	0.050	0.00043
	11.0	^{141}Ce	0.13	0.052	0.0021
	25.0	^{144}Ce	0.51	0.28	0.028

Table 3. (continued)

Sampling Location	No. Days Sampled[a]	Type of Radioactivity	Radioactivity Concentration ($10^{-12}\mu Ci/ml$) C_{Max}	C_{Min}	C_{Avg}^{b}
Shoshone, CA	22.0	^{95}Zr	0.50	0.21	0.021
	11.0	^{103}Ru	0.081	0.046	0.0018
	11.0	^{106}Ru	0.73	0.30	0.012
	11.0	^{141}Ce	0.090	0.065	0.0024
	11.0	^{144}Ce	0.53	0.23	0.012
Needles, CA	21.0	^{95}Zr	0.40	0.077	0.030
	21.0	^{106}Ru	0.58	0.25	0.049
	4.0	^{140}Ba	0.044	0.044	0.0010
	17.0	^{144}Ce	0.52	0.17	0.041
Barstow, CA	18.0	^{95}Zr	0.28	0.054	0.0084
	6.0	^{103}Ru	0.056	0.038	0.00071
	12.0	^{106}Ru	0.30	0.088	0.0068
	6.0	^{141}Ce	0.055	0.044	0.00083
	9.0	^{144}Ce	0.35	0.14	0.0064
Bishop, CA	54.0	^{95}Zr	0.76	0.10	0.040
	13.0	^{103}Ru	0.11	0.047	0.0029
	41.0	^{106}Ru	1.1	0.21	0.049
	7.0	^{140}Ba	0.058	0.046	0.00095
	13.0	^{141}Ce	0.11	0.066	0.0030
	27.0	^{144}Ce	1.0	0.17	0.032

Table 3. (continued)

Sampling Location	No. Days Sampled[a]	Type of Radioactivity	Radioactivity Concentration ($10^{-12}\mu Ci/ml$) C_{Max}	C_{Min}	C_{Avg}[b]
Lone Pine, CA	21.0	^{95}Zr	0.39	0.23	0.023
	9.0	^{103}Ru	0.075	0.062	0.0021
	12.0	^{106}Ru	0.52	0.28	0.017
	9.0	^{141}Ce	0.080	0.050	0.0021
	12.0	^{144}Ce	0.49	0.34	0.017
Ridgecrest, CA	2.0	^{7}Be	0.28	0.28	0.0015
	19.0	^{95}Zr	0.42	0.12	0.013
	9.0	^{103}Ru	0.062	0.049	0.0014
	8.0	^{106}Ru	0.66	0.17	0.0077
	9.0	^{141}Ce	0.063	0.046	0.0014
	8.0	^{144}Ce	0.64	0.28	0.0083
Baker, CA	38.0	^{95}Zr	0.44	0.18	0.032
	17.0	^{103}Ru	0.10	0.034	0.0034
	21.0	^{106}Ru	0.60	0.32	0.024
	17.0	^{141}Ce	0.080	0.051	0.0032
	21.0	^{144}Ce	0.55	0.31	0.025
Alamo, NV	6.0	^{7}Be	0.21	0.17	0.0032
	41.0	^{95}Zr	0.36	0.032	0.023
	17.0	^{103}Ru	0.36	0.038	0.0041
	19.0	^{106}Ru	0.49	0.025	0.018
	3.0	^{140}Ba	0.052	0.052	0.00043
	11.0	^{141}Ce	0.28	0.044	0.0029
	13.0	^{144}Ce	0.45	0.27	0.013

Table 3. (continued)

Sampling Location	No. Days Sampled[a]	Type of Radioactivity	Radioactivity Concentration (10^{-12} μCi/ml) C_{Max}	C_{Min}	C_{Avg}[b]
Beatty, NV	35.0	^{95}Zr	0.47	0.10	0.027
	19.0	^{103}Ru	0.076	0.028	0.0030
	14.0	^{106}Ru	0.41	0.25	0.013
	19.0	^{141}Ce	0.10	0.033	0.0034
	14.0	^{144}Ce	0.43	0.25	0.014
Caliente, NV	6.0	^{7}Be	0.17	0.13	0.0026
	42.0	^{95}Zr	0.37	0.026	0.025
	22.0	^{103}Ru	0.080	0.039	0.0036
	17.0	^{106}Ru	0.39	0.015	0.012
	22.0	^{141}Ce	0.082	0.036	0.0037
	14.0	^{144}Ce	0.38	0.13	0.011
Diablo, NV	35.0	^{95}Zr	0.66	0.068	0.028
	16.0	^{103}Ru	0.096	0.042	0.0028
	19.0	^{106}Ru	0.41	0.24	0.018
	3.0	^{140}Ba	0.055	0.055	0.00045
	16.0	^{141}Ce	0.087	0.031	0.0025
	16.0	^{144}Ce	0.42	0.21	0.014
Ely, NV	14.0	^{95}Zr	0.48	0.074	0.0091
	3.0	^{103}Ru	0.048	0.048	0.00042
	11.0	^{106}Ru	0.37	0.23	0.0084
	3.0	^{140}Ba	0.043	0.043	0.00037
	3.0	^{141}Ce	0.045	0.045	0.00039
	8.0	^{144}Ce	0.64	0.17	0.0084

Sampling Location	No. Days Sampled[a]	Type of Radioactivity	Radioactivity Concentration ($10^{-12}\mu Ci/ml$) C_{Max}	C_{Min}	C_{Avg}[b]
Fallini's Rch., NV (Twin Springs)	5.0	^{7}Be	0.40	0.21	0.0041
	55.0	^{95}Zr	0.93	0.051	0.044
	25.0	^{103}Ru	0.072	0.021	0.0036
	31.0	^{106}Ru	0.66	0.024	0.029
	3.0	^{140}Ba	0.47	0.47	0.0041
	22.0	^{141}Ce	0.088	0.033	0.0040
	23.0	^{144}Ce	0.65	0.16	0.024
Goldfield, NV	18.0	^{95}Zr	0.42	0.20	0.015
	9.0	^{103}Ru	0.057	0.032	0.0013
	9.0	^{106}Ru	0.35	0.29	0.0085
	9.0	^{141}Ce	0.084	0.056	0.0017
	9.0	^{144}Ce	0.54	0.29	0.011
Hiko, NV	3.0	^{7}Be	0.17	0.17	0.0014
	50.0	^{95}Zr	0.50	0.082	0.035
	23.0	^{103}Ru	0.094	0.028	0.0035
	25.0	^{106}Ru	0.50	0.019	0.025
	3.0	^{140}Ba	0.060	0.060	0.00051
	23.0	^{141}Ce	0.090	0.040	0.0041
	19.0	^{144}Ce	0.54	0.18	0.018
Indian Springs, NV	8.0	^{95}Zr	0.28	0.17	0.0055
	8.0	^{103}Ru	0.056	0.047	0.0011
	8.0	^{141}Ce	0.061	0.036	0.0012

Table 3. (continued)

Sampling Location	No. Days Sampled[a]	Type of Radioactivity	Radioactivity Concentration (10^{-12} µCi/ml) C_{Max}	C_{Min}	C_{Avg}^{b}
Las Vegas, NV	36.0	^{95}Zr	0.44	0.065	0.025
	15.0	^{103}Ru	0.10	0.038	0.0028
	20.0	^{106}Ru	0.46	0.15	0.018
	5.0	^{140}Ba	0.049	0.048	0.00066
	15.0	^{141}Ce	0.095	0.059	0.0032
	15.0	^{144}Ce	0.44	0.16	0.014
Lathrop Wells, NV	24.0	^{95}Zr	0.35	0.022	0.016
	13.0	^{103}Ru	0.064	0.049	0.0020
	11.0	^{106}Ru	0.34	0.25	0.0090
	13.0	^{141}Ce	0.079	0.051	0.0022
	11.0	^{144}Ce	0.37	0.27	0.0091
Lund, NV	35.0	^{95}Zr	0.38	0.099	0.024
	19.0	^{103}Ru	0.072	0.034	0.0030
	16.0	^{106}Ru	0.48	0.24	0.016
	3.0	^{140}Ba	0.033	0.033	0.00028
	19.0	^{141}Ce	0.075	0.032	0.0029
	13.0	^{144}Ce	0.52	0.30	0.013
Mesquite, NV	16.0	^{95}Zr	0.32	0.21	0.011
	13.0	^{103}Ru	0.078	0.036	0.0017
	3.0	^{106}Ru	0.37	0.37	0.0030
	13.0	^{141}Ce	0.071	0.042	0.0020
	3.0	^{144}Ce	0.30	0.30	0.0025

Table 3. (continued)

Sampling Location	No. Days Sampled[a]	Type of Radioactivity	Radioactivity Concentration ($10^{-12}\mu Ci/ml$) C_{Max}	C_{Min}	C_{Avg}^{b}
Pahrump, NV	42.0	^{95}Zr	0.34	0.026	0.020
	19.0	^{103}Ru	0.085	0.020	0.0026
	13.0	^{106}Ru	0.95	0.25	0.016
	2.0	^{140}Ba	0.079	0.079	0.00044
	11.0	^{141}Ce	0.072	0.036	0.0013
	9.0	^{144}Ce	0.48	0.25	0.0090
Pioche, NV	37.0	^{95}Zr	0.35	0.066	0.026
	16.0	^{103}Ru	0.087	0.037	0.0026
	21.0	^{106}Ru	0.45	0.18	0.020
	3.0	^{140}Ba	0.036	0.036	0.00030
	13.0	^{141}Ce	0.091	0.048	0.0025
	18.0	^{144}Ce	0.48	0.26	0.013
Tonopah, NV	50.0	^{95}Zr	0.72	0.062	0.033
	16.0	^{103}Ru	0.078	0.051	0.0029
	34.0	^{106}Ru	0.63	0.18	0.032
	6.0	^{140}Ba	0.064	0.040	0.00036
	16.0	^{141}Ce	0.10	0.050	0.0030
	18.0	^{144}Ce	0.51	0.22	0.020
TTR, NV	25.0	^{95}Zr	0.42	0.078	0.019
	9.0	^{103}Ru	0.054	0.040	0.0013
	16.0	^{106}Ru	0.72	0.21	0.017
	3.0	^{140}Ba	0.053	0.053	0.00049
	9.0	^{141}Ce	0.072	0.034	0.0016
	13.0	^{144}Ce	0.61	0.28	0.014

Table 3. (continued)

Sampling Location	No. Days Sampled[a]	Type of Radioactivity	Radioactivity Concentration ($10^{-12}\mu Ci/ml$) C_{Max}	C_{Min}	C_{Avg}^{b}
Warm Springs, NV	12.0	^{95}Zr	0.37	0.19	0.026
	8.0	^{103}Ru	0.071	0.037	0.0034
	4.0	^{106}Ru	0.41	0.41	0.012
	5.0	^{141}Ce	0.076	0.071	0.0028
	4.0	^{144}Ce	0.48	0.48	0.014
Pedersen Valley View Rch., NV	28.0	^{95}Zr	0.40	0.18	0.022
	12.0	^{103}Ru	0.080	0.060	0.0024
	16.0	^{106}Ru	0.46	0.25	0.015
	9.0	^{141}Ce	0.082	0.044	0.0016
	16.0	^{144}Ce	0.42	0.24	0.015
Eureka, NV	26.0	^{95}Zr	0.46	0.18	0.020
	10.0	^{103}Ru	0.093	0.043	0.0018
	16.0	^{106}Ru	0.65	0.28	0.018
	7.0	^{141}Ce	0.073	0.044	0.0011
	16.0	^{144}Ce	0.69	0.32	0.018
Currant, NV Blue Eagle Ranch	25.0	^{95}Zr	0.55	0.14	0.022
	7.0	^{103}Ru	0.12	0.056	0.0017
	18.0	^{106}Ru	0.67	0.20	0.018
	7.0	^{141}Ce	0.11	0.065	0.0016
	18.0	^{144}Ce	0.58	0.21	0.019

Table 3. (continued)

Sampling Location	No. Days Sampled[a]	Type of Radioactivity	Radioactivity Concentration ($10^{-12} \mu Ci/ml$) C_{Max}	C_{Min}	C_{Avg}^{b}
Blue Jay, NV	3.0	^{7}Be	0.23	0.23	0.0019
	51.0	^{95}Zr	0.45	0.059	0.036
	24.0	^{103}Ru	0.077	0.027	0.0034
	27.0	^{106}Ru	0.65	0.026	0.023
	24.0	^{141}Ce	0.079	0.035	0.0040
	21.0	^{144}Ce	0.71	0.25	0.025
Groom Lake, NV	39.0	^{95}Zr	0.35	0.10	0.030
	20.0	^{103}Ru	0.081	0.039	0.0034
	19.0	^{106}Ru	0.58	0.29	0.023
	20.0	^{141}Ce	0.067	0.030	0.0029
	19.0	^{144}Ce	0.57	0.22	0.021
Sunnyside, NV	17.0	^{95}Zr	0.35	0.13	0.013
	5.0	^{103}Ru	0.057	0.040	0.00081
	11.0	^{106}Ru	0.44	0.24	0.011
	5.0	^{141}Ce	0.058	0.047	0.00090
	11.0	^{144}Ce	0.50	0.23	0.014
Lida, NV	23.0	^{95}Zr	0.45	0.19	0.019
	7.0	^{103}Ru	0.090	0.065	0.0015
	16.0	^{106}Ru	0.65	0.19	0.016
	7.0	^{141}Ce	0.11	0.036	0.0015
	16.0	^{144}Ce	0.48	0.27	0.016

Table 3. (continued)

Sampling Location	No. Days Sampled[a]	Type of Radioactivity	Radioactivity Concentration (10^{-12} µCi/ml) C_{Max}	C_{Min}	C_{Avg}^{b}
Round Mountain, NV	32.0	^{95}Zr	0.54	0.076	0.025
	7.0	^{103}Ru	0.074	0.057	0.0014
	25.0	^{106}Ru	0.81	0.24	0.026
	3.0	^{140}Ba	0.051	0.051	0.00046
	7.0	^{141}Ce	0.11	0.072	0.0018
	22.0	^{144}Ce	0.81	0.15	0.022
Austin, NV	9.0	^{95}Zr	0.86	0.045	0.0073
	11.0	^{106}Ru	0.24	0.097	0.0063
	4.0	^{140}Ba	0.028	0.028	0.00038
Nyala, NV	32.0	^{95}Zr	0.56	0.10	0.027
	11.0	^{103}Ru	0.12	0.035	0.0018
	21.0	^{106}Ru	0.59	0.26	0.021
	5.0	^{140}Ba	0.084	0.068	0.0011
	11.0	^{141}Ce	0.14	0.039	0.0021
	16.0	^{144}Ce	0.86	0.40	0.022
Scotty's Jct., NV	3.0	^{7}Be	0.28	0.28	0.0024
	44.0	^{95}Zr	0.41	0.15	0.033
	17.0	^{103}Ru	0.089	0.028	0.0027
	27.0	^{106}Ru	0.73	0.035	0.027
	14.0	^{141}Ce	0.083	0.038	0.0023
	25.0	^{144}Ce	0.54	0.028	0.024
Duckwater, NV	11.0	^{95}Zr	0.48	0.13	0.0081
	11.0	^{106}Ru	0.60	0.20	0.011
	8.0	^{144}Ce	0.62	0.33	0.0094

Table 3. (continued)

Sampling Location	No. Days Sampled[a]	Type of Radioactivity	Radioactivity Concentration (10^{-12} μCi/ml) C_{Max}	C_{Min}	C_{Avg}^{b}
Stone Cabin Rch., NV	11.0	^{95}Zr	0.49	0.21	0.0081
	11.0	^{106}Ru	0.75	0.25	0.012
	11.0	^{144}Ce	0.57	0.29	0.011
St. George, UT	24.0	^{95}Zr	0.47	0.21	0.024
	17.0	^{103}Ru	0.077	0.055	0.0030
	8.0	^{106}Ru	0.41	0.33	0.0079
	17.0	^{141}Ce	0.091	0.047	0.0033
	8.0	^{144}Ce	0.67	0.34	0.012
Garrison, UT	34.0	^{95}Zr	0.35	0.082	0.023
	15.0	^{103}Ru	0.075	0.049	0.0027
	19.0	^{106}Ru	0.46	0.19	0.019
	3.0	^{140}Ba	0.050	0.050	0.00042
	15.0	^{141}Ce	0.075	0.053	0.0026
	16.0	^{144}Ce	0.38	0.18	0.014
Cedar City, UT	3.0	^{95}Zr	0.20	0.20	0.0024
	3.0	^{103}Ru	0.072	0.072	0.00087
	3.0	^{141}Ce	0.036	0.036	0.00043
Milford, UT	19.0	^{95}Zr	0.33	0.16	0.013
	6.0	^{103}Ru	0.064	0.060	0.0011
	13.0	^{106}Ru	0.36	0.20	0.012
	6.0	^{141}Ce	0.064	0.060	0.0011
	13.0	^{144}Ce	0.36	0.18	0.0100

Table 3. (continued)

Sampling Location	No. Days Sampled[a]	Type of Radioactivity	Radioactivity Concentration ($10^{-12}\mu Ci/ml$) C_{Max}	C_{Min}	C^{b}_{Avg}
Delta, UT	12.0	^{95}Zr	0.31	0.16	0.0084
	6.0	^{103}Ru	0.055	0.022	0.00066
	6.0	^{106}Ru	0.40	0.31	0.0061
	6.0	^{141}Ce	0.059	0.039	0.00083
	6.0	^{144}Ce	0.34	0.33	0.0057

[a] Represents the number of sampling days of the year during which the radionuclide was detected.

[b] All averages were computed over the total operating time of each station during the year. The total times for the stations were slightly less than 365 days due to equipment failure etc.; however, the concentration averages were considered to be representative for the full year. Due to the lack of statistically derived MDC's, the averages were calculated assuming that concentrations were zero when the nuclides could not be detected.

Table 4. 1974 Summary of Analytical Results
for the Noble Gas and Tritium Surveillance Network

Sampling Location	No. Days Sampled	Type of Radio-activity	Units	C_{Max}	C_{Min}	C_{Avg}	% of Conc. Guide*
Death Valley Jct., CA	328.0	^{85}Kr	$10^{-12}\mu Ci/ml$ air	29	13	18	0.018
	335.0	Total Xe	$10^{-12}\mu Ci/ml$ air	< 5.4	< 2.0	< 3.3	<0.0033
	328.0	^3H as HTO	$10^{-6}\mu Ci/ml$ H_2O	< 1.6	< 0.21	< 0.46	-
	344.0	^3H as CH_3T	$10^{-12}\mu Ci/ml$ air	9.4	< 1.3	< 3.1	
	344.0	^3H as HTO	$10^{-12}\mu Ci/ml$ air	6.2	< 0.23	< 2.0	<0.011
	352.0	^3H as HT	$10^{-12}\mu Ci/ml$ air	12	< 0.14	< 2.6	
Beatty, NV	356.0	^{85}Kr	$10^{-12}\mu Ci/ml$ air	27	12	17	0.017
	363.0	^{133}Xe	$10^{-12}\mu Ci/ml$ air	140	< 2.0	< 7.4	<0.0074
	363.0	^3H as HTO	$10^{-6}\mu Ci/ml$ H_2O	< 2.1	< 0.22	< 0.51	-
	363.0	^3H as CH_3T	$10^{-12}\mu Ci/ml$ air	< 5.0	< 1.7	< 3.0	
	363.0	^3H as HTO	$10^{-12}\mu Ci/ml$ air	6.1	< 0.56	< 2.5	<0.012
	363.0	^3H as HT	$10^{-12}\mu Ci/ml$ air	10	< 0.42	< 2.3	
Diablo, NV	356.0	^{85}Kr	$10^{-12}\mu Ci/ml$ air	29	13	17	0.017
	356.0	^{133}Xe	$10^{-12}\mu Ci/ml$ air	17	< 2.0	< 3.7	<0.0037
	357.0	^3H as HTO	$10^{-6}\mu Ci/ml$ H_2O	0.98	< 0.21	< 0.44	-
	349.0	^3H as CH_3T	$10^{-12}\mu Ci/ml$ air	5.6	< 1.4	< 3.0	
	357.0	^3H as HTO	$10^{-12}\mu Ci/ml$ air	7.2	< 0.82	< 2.3	<0.010
	357.0	^3H as HT	$10^{-12}\mu Ci/ml$ air	5.7	0.25	< 1.5	
Hiko, NV	348.0	^{85}Kr	$10^{-12}\mu Ci/ml$ air	22	12	17	0.017
	348.0	Total Xe	$10^{-12}\mu Ci/ml$ air	< 6.2	< 2.0	< 3.2	<0.0032
	298.0	^3H as HTO	$10^{-6}\mu Ci/ml$ H_2O	< 1.6	< 0.21	< 0.39	-
	341.0	^3H as CH_3	$10^{-12}\mu Ci/ml$ air	< 5.0	< 1.7	< 3.0	
	298.0	^3H as HTO	$10^{-12}\mu Ci/ml$ air	4.4	< 0.48	< 1.8	<0.0086
	298.0	^3H as HT	$10^{-12}\mu Ci/ml$ air	2.7	< 0.37	< 0.88	

Table 4. (continued)

Sampling Location	No. Days Sampled	Type of Radio-activity	Units	C_{Max}	C_{Min}	C_{Avg}	% of Conc. Guide*
Las Vegas, NV NVOO	295.0	^{85}Kr	$10^{-12}\mu Ci/ml$ air	21	13	17	0.017
	290.0	Total Xe	$10^{-12}\mu Ci/ml$ air	< 6.9	< 2.0	< 3.4	<0.0034
	342.0	^{3}H as HTO	$10^{-6}\mu Ci/ml$ H_2O	1.2	< 0.21	< 0.40	-
	297.0	^{3}H as CH_3T	$10^{-12}\mu Ci/ml$ air	< 5.0	< 1.7	< 2.8	
	342.0	^{3}H as HTO	$10^{-12}\mu Ci/ml$ air	5.9	< 0.45	< 2.0	<0.0089
	342.0	^{3}H as HT	$10^{-12}\mu Ci/ml$ air	<18	< 0.28	< 1.2	
NTS, NV Desert Rock	355.0	^{85}Kr	$10^{-12}\mu Ci/ml$ air	31	12	18	0.00018
	368.0	^{133}Xe	$10^{-12}\mu Ci/ml$ air	53	< 2.0	< 4.2	<0.000042
	368.0	^{3}H as HTO	$10^{-6}\mu Ci/ml$ H_2O	3.0	< 0.21	< 0.50	-
	361.0	^{3}H as CH_3T	$10^{-12}\mu Ci/ml$ air	< 8.8	< 1.5	< 3.0	
	368.0	^{3}H as HTO	$10^{-12}\mu Ci/ml$ air	15	< 0.74	< 2.6	<0.00014
	368.0	^{3}H as HT	$10^{-12}\mu Ci/ml$ air	9.2	< 0.36	< 1.4	
NTS, NV BJY	327.0	^{85}Kr	$10^{-12}\mu Ci/ml$ air	32	13	19	0.00019
	340.0	^{133}Xe	$10^{-12}\mu Ci/ml$ air	1000	< 2.0	<44	<0.00044
	355.0	^{3}H as HTO	$10^{-6}\mu Ci/ml$ H_2O	13	0.26	3.0	-
	340.0	^{3}H as CH_3T	$10^{-12}\mu Ci/ml$ air	20	< 1.7	< 3.5	
	355.0	^{3}H as HTO	$10^{-12}\mu Ci/ml$ air	59	10	13	<0.00041
	355.0	^{3}H as HT	$10^{-12}\mu Ci/ml$ air	34	< 0.34	< 4.1	
NTS, NV Gate 700	348.0	^{85}Kr	$10^{-12}\mu Ci/ml$ air	22	12	17	0.00017
	348.0	Total Xe	$10^{-12}\mu Ci/ml$ air	6.3	< 2.0	< 3.3	<0.000033
	356.0	^{3}H as HTO	$10^{-6}\mu Ci/ml$ H_2O	8.3	< 0.21	< 0.78	-
	342.0	^{3}H as CH_3T	$10^{-12}\mu Ci/ml$ air	6.3	< 1.7	< 3.1	
	356.0	^{3}H as HTO	$10^{-12}\mu Ci/ml$ air	35	0.64	< 3.6	<0.00021
	356.0	^{3}H as HT	$10^{-12}\mu Ci/ml$ air	<14	0.58	< 3.7	

Table 4. (continued)

Sampling Location	No. Days Sampled	Type of Radio-activity	Units	C_{Max}	C_{Min}	C_{Avg}	% of Conc. Guide*
NTS, NV Area 12	334.0	^{85}Kr	$10^{-12}\mu Ci/ml$ air	23	10	18	0.00018
	361.0	^{133}Xe	$10^{-12}\mu Ci/ml$ air	1100	< 2.0	<16	<0.00016
	354.0	^{3}H as HTO	$10^{-6}\mu Ci/ml$ H_2O	93	< 0.26	<13	-
	361.0	^{3}H as CH_3T	$10^{-12}\mu Ci/ml$ air	< 8.5	< 1.7	< 3.2	
	353.0	^{3}H as HTO	$10^{-12}\mu Ci/ml$ air	600	2.0	<59	<0.0013
	353.0	^{3}H as HT	$10^{-12}\mu Ci/ml$ air	36	0.34	< 4.0	
Tonopah, NV	344.0	^{85}Kr	$10^{-12}\mu Ci/ml$ air	25	11	18	0.018
	356.0	Total Xe	$10^{-12}\mu Ci/ml$ air	< 6.9	< 2.0	< 3.7	<0.0037
	357.0	^{3}H as HTO	$10^{-6}\mu Ci/ml$ H_2O	1.0	< 0.21	< 0.42	-
	350.0	^{3}H as CH_3T	$10^{-12}\mu Ci/ml$ air	< 5.0	< 1.7	< 2.8	
	357.0	^{3}H as HTO	$10^{-12}\mu Ci/ml$ air	5.2	< 0.59	< 2.0	<0.010
	364.0	^{3}H as HT	$10^{-12}\mu Ci/ml$ air	4.5	< 0.41	< 1.9	

* Concentration Guides used for NTS stations are those applicable to exposures to radiation workers. Those used for off-NTS stations are for exposure to a suitable sample of the population in an uncontrolled area.

Table 5. 1974 Summary of Background Radiation Doses for the Dosimetry Network

Station Location	Measurement Period	Background Dose Equivalent Rate (mrem/d) Max.	Min.	Avg.	Annual Adjusted Background Dose Equivalent (mrem/a)
Adaven, NV	1/16/74 - 1/08/75	0.46	0.35	0.41	150
Alamo, NV	1/07/74 - 1/06/75	0.36	0.23	0.32	120
Baker, CA	1/14/74 - 1/06/75	0.34	0.24	0.29	110
Barstow, CA	1/14/74 - 1/06/75	0.36	0.28	0.33	120
Beatty, NV	1/08/74 - 1/14/75	0.38	0.36	0.37	140
Bishop, CA	1/16/74 - 1/08/75	0.35	0.26	0.30	110
Blue Eagle Rch., NV	1/16/74 - 1/07/75	0.33	0.14	0.24	86
Blue Jay, NV	1/17/74 - 1/08/75	0.40	0.34	0.38	140
Cactus Springs, NV	1/07/74 - 1/13/75	0.26	0.19	0.22	80
Caliente, NV	1/10/74 - 1/08/75	0.43	0.26	0.34	120
Casey's Ranch, NV	1/08/74 - 1/07/75	0.29	0.23	0.26	96
Cedar City, UT	1/16/74 - 1/15/75	0.28	0.22	0.26	95
Clark Station, NV	1/17/74 - 1/08/75	0.38	0.32	0.36	130
Coyote Summit, NV	1/07/74 - 1/06/75	0.40	0.30	0.36	130
Currant, NV	1/16/74 - 1/07/75	0.40	0.21	0.31	110
Death Valley Jct., CA	1/17/74 - 1/15/75	0.34	0.24	0.28	100
Desert Game Range, NV	1/07/74 - 1/13/75	0.21	0.17	0.19	68
Diablo Maint. Sta., NV	1/09/74 - 1/09/75	0.43	0.36	0.40	150
Duckwater, NV	1/16/74 - 1/07/75	0.40	0.26	0.35	130
Elgin, NV	1/11/74 - 1/08/75	0.49	0.27	0.40	150
Ely, NV	1/15/74 - 1/06/75	0.38	0.31	0.34	130
Enterprise, UT	1/16/74 - 1/15/75	0.37	0.31	0.33	120
Furnace Creek, CA	1/08/74 - 1/08/75	0.27	0.21	0.24	87
Geyser Maint. Sta., NV	1/14/74 - 1/06/75	0.35	0.30	0.32	120
Goldfield, NV	1/08/74 - 1/13/75	0.40	0.26	0.32	120
Groom Lake, NV	1/17/74 - 1/06/75	0.31	0.11	0.23	83

Table 5. (continued)

Station Location	Measurement Period	Background Dose Equivalent Rate (mrem/d) Max.	Min.	Avg.	Annual Adjusted Background Dose Equivalent (mrem/a)
Hancock Summit, NV	1/07/74 - 1/06/75	0.46	0.32	0.41	150
Hiko, NV	1/07/74 - 1/06/75	0.32	0.21	0.28	100
Hot Creek Ranch, NV	1/17/74 - 1/08/75	0.36	0.27	0.31	110
Independence, CA	1/16/74 - 1/07/75	0.38	0.28	0.33	120
Indian Springs, NV	1/07/74 - 1/13/75	0.25	0.22	0.23	83
Kirkeby Ranch, NV	1/14/74 - 1/06/75	0.30	0.23	0.27	100
Koynes, NV	1/09/74 - 1/09/75	0.36	0.27	0.32	120
Las Vegas (McCarran), NV	1/14/74 - 1/10/75	0.21	0.09	0.17	62
Las Vegas (Piacak), NV	1/14/74 - 1/10/75	0.26	0.13	0.20	74
Las Vegas (USDI), NV	1/14/74 - 1/10/75	0.33	0.13	0.24	86
Lathrop Wells, NV	1/09/74 - 1/15/75	0.37	0.28	0.32	120
Lida, NV	1/07/74 - 1/13/75	0.45	0.32	0.37	130
Lone Pine, CA	1/16/74 - 1/07/75	0.37	0.26	0.31	110
Lund, NV	1/16/74 - 1/08/75	0.33	0.23	0.28	100
Manhattan, NV	1/10/74 - 1/14/75	0.51	0.37	0.43	160
Mesquite, NV	1/15/74 - 1/13/75	0.28	0.18	0.25	90
Nevada Farms, NV	1/07/74 - 1/06/75	0.42	0.32	0.36	130
Nuclear Eng. Co., NV	1/09/74 - 1/15/75	0.39	0.33	0.36	130
Nyala, NV	1/08/74 - 1/07/75	0.31	0.25	0.29	110
Olancha, CA	1/15/74 - 1/07/75	0.32	0.26	0.29	100
Pahrump, NV	1/10/74 - 1/16/75	0.34	0.24	0.29	100
Pine Creek Ranch, NV	1/16/74 - 1/08/75	0.38	0.34	0.37	140
Pioche, NV	1/10/74 - 1/07/75	0.35	0.30	0.34	120
Queen City Summit, NV	1/07/74 - 1/06/75	0.46	0.37	0.42	150
Reed Ranch, NV	1/07/74 - 1/06/75	0.40	0.32	0.37	130
Ridgecrest, CA	1/15/74 - 1/07/75	0.27	0.23	0.25	92
Round Mountain, NV	1/09/74 - 1/14/75	0.41	0.30	0.37	140

Table 5. (continued)

Station Location	Measurement Period	Background Dose Equivalent Rate (mrem/d) Max.	Min.	Avg.	Annual Adjusted Background Dose Equivalent (mrem/a)
Scotty's Junction, NV	1/07/74 - 1/10/75	0.45	0.34	0.39	140
Selbach Ranch, NV	1/09/74 - 1/16/75	0.36	0.30	0.33	120
Sherri's Bar, NV	1/07/74 - 1/06/75	0.30	0.21	0.26	93
Shoshone, CA	1/17/74 - 1/15/75	0.41	0.32	0.35	130
Spring Meadows, NV	1/10/74 - 1/16/75	0.25	0.23	0.24	89
Springdale, NV	1/10/74 - 1/14/75	0.42	0.37	0.39	140
St. George, UT	1/17/74 - 1/13/75	0.30	0.18	0.25	91
Sunnyside, NV	1/16/74 - 1/08/75	0.34	0.26	0.30	110
Tempiute, NV	1/09/74 - 1/06/75	0.36	0.16	0.30	110
Tenneco, NV	1/10/74 - 1/16/75	0.39	0.34	0.36	130
Tonopah Test Range, NV	1/08/74 - 1/09/75	0.35	0.27	0.31	110
Tonopah, NV	1/08/74 - 1/09/75	0.52	0.34	0.40	150
Twin Springs Ranch, NV	1/10/74 - 1/08/75	0.43	0.31	0.37	130
Valley View Ranch, NV	1/15/74 - 1/13/75	0.32	0.21	0.25	91
Warm Springs, NV	1/17/74 - 1/08/75	0.38	0.30	0.35	130
Young's Ranch, NV	1/09/74 - 1/14/75	0.38	0.29	0.32	120

Table 6. 1974 Summary of Analytical Results for the Milk Surveillance Network

Sampling Location	Sample Type[a]	No. of Samples	Type of Radio activity	Radioactivity Conc. (10^{-9}µCi/ml) C_{Max}	C_{Min}	C_{Avg}
Bishop, CA Sierra Creamery	11	4	^{137}Cs	<10	<10	<10
		4	^{89}Sr	< 2.7	< 1.4	< 1.9
		4	^{90}Sr	2.2	< 1.2	< 1.7
Hinkley, CA Bill Nelson Dairy	12	4	^{137}Cs	<10	<10	<10
		4	^{89}Sr	< 2.6	< 1.4	< 1.8
		4	^{90}Sr	1.5	< 0.88	< 1.3
Olancha, CA Hunter Ranch	13	3	^{137}Cs	<10	<10	<10
		3	^{89}Sr	< 1.9	< 1.3	< 1.5
		3	^{90}Sr	< 1.1	< 0.92	< 1.0
Alamo, NV Williams Dairy	12	3	^{137}Cs	<10	<10	<10
		3	^{89}Sr	< 1.8	< 1.6	< 1.7
		3	^{90}Sr	1.9	< 1.0	< 1.3
Austin, NV Young's Ranch	13	4	^{137}Cs	<10	<10	<10
		4	^{89}Sr	< 3.4	< 1.4	< 2.1
		4	^{90}Sr	2.2	< 1.5	< 1.8
		4	^{3}H	910	560	768
Currant, NV Blue Eagle Ranch	13	4	^{137}Cs	25	<10	<14
		4	^{89}Sr	< 2.4	< 1.4	< 1.8
		4	^{90}Sr	< 2.0	< 1.0	< 1.4

Table 6. (continued)

Sampling Location	Sample Type[a]	No. of Samples	Type of Radio activity	Radioactivity Conc. ($10^{-9}\mu Ci/ml$) C_{Max}	C_{Min}	C_{Avg}
Currant, NV Manzonie Ranch	13	4	^{137}Cs	<10	<10	<10
		4	^{89}Sr	< 2.7	< 1.2	< 1.9
		4	^{90}Sr	2.0	< 1.0	< 1.5
Hiko, NV Schofield Dairy	12	4	^{137}Cs	<10	<10	<10
		4	^{89}Sr	< 4.2	< 1.5	< 2.3
		4	^{90}Sr	3.8	< 1.1	< 2.1
		4	^{3}H	430	<240	<340
Indian Springs, NV Indian Springs Rch.	13	1	^{137}Cs	<10	<10	<10
		1	^{89}Sr	< 2.9	< 2.9	< 2.9
		1	^{90}Sr	< 1.1	< 1.1	< 1.1
Las Vegas, NV LDS Dairy Farm	12	4	^{137}Cs	<10	<10	<10
		4	^{89}Sr	< 2.9	< 1.1	< 1.7
		4	^{90}Sr	1.7	< 0.98	< 1.2
		4	^{3}H	350	<260	<290
Lathrop Wells, NV William J. Kirker	13	3	^{137}Cs	<10	<10	<10
		3	^{89}Sr	< 3.3	< 1.3	< 2.2
		3	^{90}Sr	1.5	< 1.1	< 1.3
Lida, NV Lida Livestock Co.	13	4	^{137}Cs	<10	<10	<10
		4	^{89}Sr	< 3.7	< 1.4	< 2.2
		4	^{90}Sr	2.6	< 0.87	< 1.4

Table 6. (continued)

Sampling Location	Sample Type[a]	No. of Samples	Type of Radio activity	Radioactivity Conc. ($10^{-9}\mu Ci/ml$) C_{Max}	C_{Min}	C_{Avg}
Logandale, NV Vegas Valley Dairy	12	4	^{137}Cs	<10	<10	<10
		4	^{89}Sr	< 5.5	< 1.5	< 2.8
		4	^{90}Sr	3.6	< 1.2	< 2.3
Lund, NV McKenzie Dairy	12	4	^{137}Cs	<10	<10	<10
		4	^{89}Sr	< 2.4	< 1.3	< 1.8
		4	^{90}Sr	2.0	1.1	< 1.5
		4	^{3}H	790	<220	<370
Mesquite, NV Hughes Bros. Dairy	12	4	^{137}Cs	<10	<10	<10
		4	^{89}Sr	< 3.2	< 1.3	< 1.9
		4	^{90}Sr	2.6	< 0.96	< 1.4
		4	^{3}H	240	<230	<230
Moapa, NV Searles Dairy	12	4	^{137}Cs	<10	<10	<10
		4	^{89}Sr	< 3.6	< 1.4	< 2.1
		4	^{90}Sr	2.8	< 0.97	< 1.7
Nyala, NV Sharp's Ranch	13	3	^{137}Cs	<10	<10	<10
		4	^{89}Sr	< 3.6	< 1.5	< 2.1
		4	^{90}Sr	2.9	< 0.97	< 2.0
		4	^{3}H	340	<210	<260
Pahrump, NV Burson Ranch	13	4	^{137}Cs	<10	<10	<10
		4	^{89}Sr	< 3.2	< 1.2	< 1.8
		4	^{90}Sr	1.5	< 0.82	< 1.1

Table 6. (continued)

Sampling Location	Sample Type[a]	No. of Samples	Type of Radio activity	Radioactivity Conc. ($10^{-9}\mu Ci/ml$) C_{Max}	C_{Min}	C_{Avg}
Panaca, NV Kenneth Lee Ranch	13	3	^{137}Cs	<10	<10	<10
		4	^{89}Sr	< 3.3	< 1.2	< 2.1
		4	^{90}Sr	1.8	< 0.93	< 1.4
Round Mountain, NV Russell Berg Ranch	13	1	^{137}Cs	<10	<10	<10
		1	^{89}Sr	< 3.5	< 3.5	< 3.5
		1	^{90}Sr	< 1.3	< 1.3	< 1.3
Round Mountain, NV Karl Berg Ranch	13	1	^{137}Cs	<10	<10	<10
		1	^{89}Sr	< 1.8	< 1.8	< 1.8
		1	^{90}Sr	4.5	4.5	4.5
Shoshone, NV Kirkeby Ranch	13	4	^{137}Cs	<10	<10	<10
		4	^{89}Sr	< 2.8	< 1.8	< 2.2
		4	^{90}Sr	3.8	< 1.2	< 2.6
Springdale, NV Seidentopf Ranch	13	4	^{137}Cs	<10	<10	<10
		4	^{89}Sr	< 3.3	< 1.6	< 2.2
		4	^{90}Sr	< 1.8	< 1.2	< 1.4
Cedar City, UT Western Gold Dairy	12	4	^{137}Cs	<10	<10	<10
		4	^{89}Sr	< 3.2	< 1.2	< 2.1
		4	^{90}Sr	3.3	< 1.4	< 2.0

Table 6. (continued)

Sampling Location	Sample Type[a]	No. of Samples	Type of Radio activity	Radioactivity Conc. ($10^{-9}\mu Ci/ml$) C_{Max}	C_{Min}	C_{Avg}
St. George, UT R. Cox Dairy	12	4	^{137}Cs	<10	<10	<10
		4	^{89}Sr	< 3.1	< 1.3	< 2.1
		4	^{90}Sr	1.3	< 0.98	< 1.2

[a] 11 = Pasteurized Milk
12 = Raw Milk from Grade A Producer(s)
13 = Raw Milk from family cow(s)

Table 7. 1974 Summary of Analytical Results for the Water Surveillance Network - Surface Water Samples

Sampling Location	Sample Type[a]	Collection Date	Type of Radioactivity	Concentration (10^{-9} μCi/ml)	% of Conc. Guide
Ely, NV Comins Lake	21	04/08/74	^{89}Sr	< 2.7	< 0.27
			^{90}Sr	< 1.2	< 1.2
			^{226}Ra	0.16	1.6
			^{238}Pu	< 0.037	< 0.0022
			^{239}Pu	0.073	0.0043
Hiko, NV Crystal Springs	27	01/10/74	^{89}Sr	< 2.5	< 0.25
			^{90}Sr	< 0.98	< 0.98
			^{226}Ra	0.67	6.7
			^{238}Pu	< 0.048	< 0.0028
			^{239}Pu	< 0.066	< 0.0039
Las Vegas, NV Lake Mead Vegas Wash	21	01/14/74	^{89}Sr	< 2.1	< 0.21
			^{90}Sr	< 1.4	< 1.4
			^{226}Ra	0.23	2.3
			^{238}Pu	0.048	0.0028
			^{239}Pu	< 0.085	< 0.0050
Las Vegas, NV Tule Springs P[illegible]	[illegible]	01/17/74	^{89}Sr	< 3.0	< 0.30
			^{90}Sr	< 0.99	< 0.99
			^{226}Ra	0.32	3.2
			^{238}Pu	< 0.042	< 0.0025
			^{239}Pu	< 0.067	< 0.0039

Table 7. (continued)

Sampling Location	Sample Type[a]	Collection Date	Type of Radioactivity	Concentration (10^{-9} μCi/ml)	% of Conc. Guide
Furnace Creek, CA Pond	21	01/08/74	^{89}Sr	< 1.4	< 0.14
			^{90}Sr	< 0.82	< 0.82
			^{226}Ra	0.16	1.6
			^{238}Pu	0.12	0.0071
			^{239}Pu	0.088	0.0052
Olancha, CA Haiwee Reservoir	21	01/15/74	^{89}Sr	< 3.5	< 0.35
			^{90}Sr	< 1.4	< 1.4
			^{226}Ra	0.32	3.2
			^{238}Pu	< 0.039	< 0.0023
			^{239}Pu	< 0.051	< 0.0030
Alamo, NV Pahranagat Lake	21	01/07/74	^{89}Sr	< 2.9	< 0.29
			^{90}Sr	< 1.1	< 1.1
			^{226}Ra	0.45	4.5
			^{238}Pu	< 0.038	< 0.0022
			^{239}Pu	< 0.068	< 0.0040
Diablo, [illegible] Reed Ranc[illegible]	21	01/07/74	^{89}Sr	< 2.6	< 0.26
			^{90}Sr	< 1.0	< 1.0
			^{226}Ra	0.089	0.89
			^{238}Pu	< 0.031	< 0.0018
			^{239}Pu	< 0.064	< 0.0038

Table 7. (continued)

Sampling Location	Sample Type[a]	Collection Date	Type of Radioactivity	Concentration (10^{-9} µCi/ml)	% of Conc. Guide
Lida, NV Pond at Storage Tank	21	01/07/74	^{89}Sr	< 3.5	< 0.35
			^{90}Sr	< 1.3	< 1.3
			^{226}Ra	0.31	3.1
			^{238}Pu	< 0.035	< 0.0021
			^{239}Pu	< 0.066	< 0.0039
Springdale, NV Pond	21	01/08/74	^{89}Sr	< 2.6	< 0.26
			^{90}Sr	< 1.1	< 1.1
			^{226}Ra	0.11	1.1
			^{238}Pu	< 0.062	< 0.0036
			^{239}Pu	< 0.083	< 0.0049
Sunnyside, NV Adam McGill Reservoir	21	01/16/74	^{89}Sr	< 2.4	< 0.24
			^{90}Sr	< 1.1	< 1.1
			^{226}Ra	1.4	14
			^{238}Pu	< 0.041	< 0.0024
			^{239}Pu	< 0.083	< 0.0049
Warm Spring[illegible] Fallini's P[illegible]	[illegible]	04/03/74	^{89}Sr	< 4.8	< 0.48
			^{90}Sr	< 0.91	< 0.91
			^{226}Ra	0.17	1.7
			^{238}Pu	< 0.038	< 0.0022
			^{239}Pu	< 0.040	< 0.0024

[a]21 = Pond, Lake, Reservoir, Stock Tank, Stock Pond

Table 8. 1974 Summary of Tritium Results for the Water Surveillance Network

Sampling Location	Sample Type[a]	No. of Samples	^3H Concentration 10^{-9} μCi/ml C_{Max}	C_{Min}	C_{Avg}	% of Conc. Guide
Death Valley Jct, CA Lila's Cafe	23	4	430	<210	<280	<0.028
Blue Diamond, NV Post Office	23	4	390	<210	<270	<0.027
Cactus Springs, NV Mobil Ser. Sta.	27	4	<240	<210	<230	<0.023
Las Vegas, NV Craig Rch. Golf Course	23	4	290	<210	<250	<0.025
Las Vegas, NV Desert Game Range	23	4	<240	<210	<230	<0.023
Las Vegas, NV Lab I, NERC-LV	24	4	1000	550	750	0.075
Las Vegas, NV Lake Mead Vegas Wash	21	4	1200	680	910	0.091
Las Vegas, NV L.V. Water Dist. Well 28	23	4	<260	<210	<230	<0.023
Las Vegas, NV Municipal Golf Course	23	4	<260	<210	<230	<0.023
Las Vegas, NV Tule Springs	23	4	350	<210	<260	<0.026
Las Vegas, NV Vegas Estates	23	4	<260	<210	<230	<0.023
Mt. Charleston, NV Kyle Cnyn. [illegible]	27	4	330	<230	<270	<0.027
Scotty's [illegible] Holloway [illegible]	23	5	450	<220	<290	<0.029

[a] 21 = Pon[illegible]rvoir, Stock Tank, Stock Pond
23 = Well
24 = Multiple Supply - Mixed (A water sample consisting of mixed or multiple sources of water, such as well and spring.)
27 = Spring

Table 9. Analytical Criteria for Long-Term Hydrological Monitoring Program Samples

	Monthly Samples	Semi-Annual Samples	Annual Samples
Gross alpha	All samples	All samples	All samples
Gross beta	All samples	All samples	All samples
Gamma scan	All samples	All samples	All samples
^{3}H[a]	All samples	All samples	All samples
$^{89-90}Sr$	Each quarter in CY 1973 Jan. and July samples in CY 1974. Any other sample if gross beta exceeds 1×10^{-8} μCi/ml.	Jan. and July samples in 1973. Jan. sample only in 1974. Any other sample if gross beta exceeds 1×10^{-8} μCi/ml.	Only if gross beta exceeds 1×10^{-8} μCi/ml.
^{226}Ra	Jan. and July samples. Any other sample if gross alpha exceeds 3×10^{-9} μCi/ml.	Jan. samples. Any other sample if gross alpha exceeds 3×10^{-9} μCi/ml.	Only if gross alpha exceeds 3×10^{-9} μCi/ml.
U	Each quarter in 1973. Jan. and July samples in 1974.	Jan. and July samples in 1973. Jan. only in 1974.	Not performed.
$^{238-239}Pu$	Each quarter in 1973. Jan. and July samples in 1974.	Jan. and July samples in 1973. Jan. only in 1974.	Not performed.

[a] Starting in January 1974, all samples were analyzed by the ^{3}H enrichment technique. (MDC~6 x 10^{-9} μCi/ml) except for the HT-2M well at the Project Dribble Site and USGS Wells #4 and 8 at the Project Gnome Site. The samples from these three contaminated wells were analyzed by conventional techniques (MDC~2.2 x 10^{-7} μCi/ml).

Table 10. 1974 Summary of Analytical Results for the NTS Monthly Long-Term Hydrological Monitoring Program

Sampling Location	No. Samples Collected	No. Samples Analyzed	Type of Radio-activity	Radioactivity Conc. 10^{-9} µCi/ml C_{Max}	C_{Min}	C_{Avg}	% of Conc. Guide[a]
NTS Well 5C	12	12	^{3}H	<11	<5.7	<8.0	<0.0001
		2	^{89}Sr	<5.1	<1.6	<3.4	<0.0011
		2	^{90}Sr	<1.2	<1.0	<1.1	<0.011
		2	^{238}Pu	<0.040	<0.030	<0.035	<0.0001
		2	^{239}Pu	<0.055	<0.036	<0.046	<0.0001
		2	^{234}U	3.9	3.0	3.5	0.00039
		2	^{235}U	0.084	0.047	0.066	<0.0001
		2	^{238}U	2.0	1.6	1.8	0.00018
		9	^{226}Ra	0.39	0.083	0.14	0.035
NTS Army Well No. 1	12	12	^{3}H	<11	<6.4	<8.2	<0.0001
		2	^{89}Sr	<6.1	<1.3	<3.7	<0.0012
		2	^{90}Sr	<1.2	<0.93	<1.1	<0.011
		2	^{238}Pu	<0.039	<0.036	<0.038	<0.0001
		2	^{239}Pu	<0.078	0.036	<0.057	<0.0001
		2	^{234}U	2.1	1.8	2.0	0.00022
		2	^{235}U	0.025	0.019	0.022	<0.0001
		2	^{238}U	0.69	0.62	0.66	<0.0001
		6	^{226}Ra	0.55	0.24	0.46	0.115
Beatty, NV Well 11S/48-1dd	11	11	^{3}H	<9.9	<5.7	<7.7	<0.00026
		2	^{89}Sr	<7.1	<2.5	<4.8	<0.0016
		2	^{90}Sr	<1.4	<1.1	<1.3	<0.013
		2	^{238}Pu	<0.054	<0.020	<0.037	<0.0001
		2	^{239}Pu	<0.072	<0.011	<0.042	<0.0001
		2	^{234}U	8.4	4.5	6.5	0.00072
		2	^{235}U	0.060	0.037	0.049	<0.0001
		2	^{238}U	1.7	0.95	1.3	0.00013
		9	^{226}Ra	0.49	0.089	0.17	0.043

Table 10. (continued)

Sampling Location	No. Samples Collected	No. Samples Analyzed	Type of Radio-activity	Radioactivity Conc. 10^{-9} μCi/ml			% of Conc. Guide[a]
				C_{Max}	C_{Min}	C_{Avg}	
NTS	7	7	^{3}H	<9.3	<6.7	<7.8	<0.0001
Well U3CN-5		5	^{89}Sr	<6.2	<1.6	<2.7	<0.00090
		5	^{90}Sr	<1.2	<0.095	<0.82	<0.0082
		1	^{238}Pu	<0.063	<0.063	<0.063	<0.0001
		1	^{239}Pu	<0.079	<0.079	<0.079	<0.0001
		1	^{234}U	2.6	2.6	2.6	0.00029
		1	^{235}U	0.036	0.036	0.036	<0.0001
		1	^{238}U	0.73	0.73	0.73	<0.0001
		6	^{226}Ra	3.0	1.8	2.3	0.58
NTS	12	12	^{3}H	18	<5.7	<8.4	<0.0001
Well A		3	^{89}Sr	<5.0	<1.3	<2.7	<0.00090
		3	^{90}Sr	<1.2	<0.99	<1.1	<0.011
		2	^{238}Pu	<0.044	<0.029	<0.037	<0.0001
		2	^{239}Pu	<0.070	<0.032	<0.051	<0.0001
		2	^{234}U	4.9	3.0	4.0	0.00044
		2	^{235}U	0.060	0.025	0.043	<0.0001
		2	^{238}U	1.3	0.90	1.1	0.00011
		10	^{226}Ra	0.36	0.084	0.15	0.038
NTS	12	12	^{3}H	150	35	93	<0.0001
Well C		11	^{89}Sr	<6.1	<1.3	<2.3	<0.00077
		11	^{90}Sr	2.5[b]	<0.78	<1.2	<0.012
		2	^{238}Pu	<0.045	<0.029	<0.037	<0.0001
		2	^{239}Pu	<0.081	<0.028	<0.055	<0.0001
		2	^{234}U	7.7	5.3	6.5	0.00072
		2	^{235}U	0.079	0.067	0.073	<0.0001
		2	^{238}U	2.1	1.4	1.8	0.00018
		2	^{226}Ra	1.4	0.59	1.1	0.2[illegible]

Table 10. (continued)

Sampling Location	No. Samples Collected	No. Samples Analyzed	Type of Radio-activity	Radioactivity Conc. 10^{-9} μCi/ml C_{Max}	C_{Min}	C_{Avg}	% of Conc. Guide
NTS	2	2	^{3}H	<7.0	<7.0	<7.0	<0.0001
Well 20A-2		1	^{89}Sr	<2.0	<2.0	<2.0	<0.00067
		1	^{90}Sr	<1.2	<1.2	<1.2	<0.012
		1	^{238}Pu	<0.017	<0.017	<0.017	<0.0001
		1	^{239}Pu	<0.015	<0.015	<0.015	<0.0001
		1	^{234}U	3.3	3.3	3.3	0.00037
		1	^{235}U	0.039	0.039	0.039	<0.0001
		1	^{238}U	0.88	0.88	0.88	<0.0001
		2	^{226}Ra	0.22	0.12	0.17	0.043
NTS	12	12	^{3}H	<10	<6.4	<8.1	<0.0001
Well 8		2	^{89}Sr	<5.8	<1.5	<3.7	<0.0012
		2	^{90}Sr	<1.1	<1.1	<1.1	<0.011
		2	^{238}Pu	<0.045	<0.021	<0.033	<0.0001
		2	^{239}Pu	<0.086	0.023	<0.055	<0.0001
		2	^{234}U	0.44	0.33	0.39	<0.0001
		2	^{235}U	<0.015	<0.0074	<0.011	<0.0001
		2	^{238}U	0.10	0.071	0.085	<0.0001
NTS	6	6	^{3}H	<9.9	<7.3	<8.2	<0.0001
Well J-12		3	^{89}Sr	<5.5	<1.0	<2.7	<0.00090
		3	^{90}Sr	<1.0	<0.080	<0.69	<0.0069
		1	^{238}Pu	<0.043	<0.043	<0.043	<0.0001
		1	^{239}Pu	<0.038	<0.038	<0.038	<0.0001
		1	^{234}U	0.93	0.93	0.93	0.0001
		1	^{235}U	<0.014	<0.014	<0.014	<0.0001
		1	^{238}U	0.19	0.19	0.19	<0.0001
		1	^{226}Ra	0.16	0.16	0.16	0.040

Table 10. (continued)

Sampling Location	No. Samples Collected	No. Samples Analyzed	Type of Radio-activity	Radioactivity Conc. 10^{-9} µCi/ml C_{Max}	C_{Min}	C_{Avg}	% of Conc. Guide[a]
NTS[d]	2	2	^{3}H	<7.0	<6.7	<6.9	<0.0001
Well J-13		1	^{89}Sr	<1.4	<1.4	<1.4	<0.00047
		1	^{90}Sr	<0.98	<0.98	<0.98	<0.0098
		1	^{238}Pu	<0.026	<0.026	<0.026	<0.0001
		1	^{239}Pu	<0.011	<0.011	<0.011	<0.0001
		1	^{234}U	1.4	1.4	1.4	0.00016
		1	^{235}U	<0.0098	<0.0098	<0.0098	<0.0001
		1	^{238}U	0.15	0.15	0.15	<0.0001
NTS	5		^{3}H				
Well UE 19G-S		1	^{89}Sr	<2.3	<2.3	<2.3	<0.00077
		1	^{90}Sr	1.9[c]	1.9[c]	1.9[c]	0.019
		1	^{238}Pu	<0.032	<0.032	<0.032	<0.0001
		1	^{239}Pu	<0.025	<0.025	<0.025	<0.0001
		1	^{234}U	9.8	9.8	9.8	0.0011
		1	^{235}U	0.11	0.11	0.11	<0.0001
		1	^{238}U	2.8	2.8	2.8	0.00024
		5	^{226}Ra	0.21	0.084	0.12	0.030

a All on-NTS percentages are for radiation workers. All off-NTS percentages are for an individual in an uncontrolled area.

b The two-sigma counting error for this sample is ± 1.3 x 10^{-9} µCi/ml.

c The two-sigma counting error for this sample is ± 1.6 x 10^{-9} µCi/ml.

d Alternate sampling location for Well J-12.

Table 11. 1974 Summary of Analytical Results for the NTS Semi-Annual Long-Term Hydrological Monitoring Program

Sampling Location	Date	Sample Type[a]	Type of Radio-activity	Radioactivity Conc. ($10^{-9}\mu Ci/ml$)	% of Conc. Guide[b]
NTS Well UE 15d	1/8	23	^{3}H	<13	<0.0001
			^{89}Sr	< 6.5	<0.0022
			^{90}Sr	< 1.3	<0.013
			^{238}Pu	< 0.057	<0.0001
			^{239}Pu	< 0.080	<0.0001
			^{234}U	4.3	0.00048
			^{235}U	0.055	<0.0001
			^{238}U	1.1	0.00011
			^{226}Ra	1.1	0.28
NTS Well UE 15d	7/9	23	^{3}H	< 8.3	<0.0001
			^{89}Sr	< 1.8	<0.00060
			^{90}Sr	< 1.3	<0.013
			^{226}Ra	1.9	0.48
NTS Well 2	1/8	23	^{3}H	<11	<0.0001
			^{89}Sr	< 5.0	<0.0017
			^{90}Sr	< 1.0	<0.010
			^{238}Pu	< 0.051	<0.0001
			^{239}Pu	< 0.089	<0.0001
			^{234}U	1.7	0.00019
			^{235}U	< 0.015	<0.0001
			^{238}U	0.34	<0.0001
NTS Well 2	7/10	23	^{3}H	< 8.3	<0.0001
NTS Well C-1	1/8	23	^{3}H	38	<0.0001
			^{89}Sr	< 5.2	<0.0017
			^{90}Sr	< 1.1	<0.011
			^{238}Pu	< 0.049	<0.0001
			^{239}Pu	< 0.085	<0.0001
			^{234}U	7.3	0.00081
			^{235}U	0.10	<0.0001
			^{238}U	2.0	0.00020

Table 11. (continued)

Sampling Location	Date	Sample Type[a]	Type of Radioactivity	Radioactivity Conc. ($10^{-9}\mu Ci/ml$)	% of Conc. Guide[b]
NTS Well C-1	7/10	23	^{3}H	16	<0.0001
			^{89}Sr	< 3.0	<0.0010
			^{90}Sr	< 1.4	<0.014
			^{226}Ra	1.4	0.35
NTS Well UE 5c	1/17	23	^{3}H	< 7.3	<0.0001
			^{89}Sr	< 6.9	<0.0023
			^{90}Sr	< 1.0	<0.010
			^{238}Pu	< 0.020	<0.0001
			^{239}Pu	0.050[c]	<0.0001
			^{234}U	3.0	<0.0001
			^{235}U	0.060	<0.0001
			^{238}U	1.0	<0.0001
NTS Well UE 5c	7/10	23	^{3}H	< 8.6	<0.0001
			^{89}Sr	< 1.9	<0.00063
			^{90}Sr	< 1.4	<0.014
			^{226}Ra	0.22	0.055
NTS Well 5B	1/9	23	^{3}H	<10	<0.0001
			^{89}Sr	< 5.6	<0.0018
			^{90}Sr	< 1.1	<0.011
			^{238}Pu	< 0.052	<0.0001
			^{239}Pu	< 0.084	<0.0001
			^{234}U	2.7	<0.00030
			^{235}U	0.088	<0.0001
			^{238}U	1.9	<0.00019
			^{226}Ra	0.20	0.050
NTS Well 5B	7/30	23	^{3}H	< 6.4	<0.0001
			^{89}Sr	< 2.0	<0.00067
			^{90}Sr	< 0.97	<0.0097
			^{226}Ra	0.078	0.020

Table 11. (continued)

Sampling Location	Date	Sample Type[a]	Type of Radio-activity	Radioactivity Conc. ($10^{-9}\mu Ci/ml$)	% of Conc. Guide[b]
NTS Watertown No. 3	1/10	23	^{3}H	< 6.7	<0.0001
			^{89}Sr	< 5.7	<0.0019
			^{90}Sr	< 1.1	<0.011
			^{238}Pu	< 0.037	<0.0001
			^{239}Pu	< 0.061	<0.0001
			^{234}U	1.3	<0.00014
			^{235}U	0.052	<0.0001
			^{238}U	0.54	<0.0001
			^{226}Ra	0.10	0.025
NTS Watertown No. 3	7/10	23	^{3}H	< 9.3	<0.0001
Ash Meadows, NV Crystal Pool	1/15	27	^{3}H	< 7.7	<0.0026
			^{89}Sr	< 4.9	<0.16
			^{90}Sr	< 0.88	<0.29
			^{238}Pu	< 0.094	<0.0019
			^{239}Pu	< 0.15	<0.0030
			^{234}U	14	<0.047
			^{235}U	0.23	<0.00077
			^{238}U	6.1	0.015
			^{226}Ra	0.095	0.32
Ash Meadows, NV Crystal Pool	7/2	27	^{3}H	< 8.0	<0.00027
			^{89}Sr	< 3.3	<0.11
			^{90}Sr	< 1.4	<0.47
			^{226}Ra	0.12	0.40
Ash Meadows, NV Well 17S/50E-14CAC	1/22	23	^{3}H	< 7.0	<0.0023
			^{89}Sr	< 7.8	<0.26
			^{90}Sr	< 1.2	<0.40
			^{238}Pu	< 0.042	<0.00084
			^{239}Pu	< 0.067	<0.0013
			^{234}U	2.4	<0.0080
			^{235}U	0.048	<0.00016
			^{238}U	0.93	<0.0023
Ash Meadows, NV Well 17S/50E-14CAC	7/2	23	^{3}H	< 7.3	<0.0024
			^{226}Ra	0.70	2.3

Table 11. (continued)

Sampling Location	Date	Sample Type[a]	Type of Radio-activity	Radioactivity Conc. ($10^{-9}\mu Ci/ml$)	% of Conc. Guide[b]
Ash Meadows, NV Fairbanks Springs	1/15	27	^{3}H	< 9.3	<0.0031
			^{89}Sr	< 5.1	<0.17
			^{90}Sr	< 0.91	<0.30
			^{238}Pu	< 0.043	<0.00086
			^{239}Pu	< 0.069	<0.00014
			^{234}U	2.1	<0.0070
			^{235}U	0.051	<0.00017
			^{238}U	0.79	<0.0020
Ash Meadows, NV Fairbanks Springs	7/2	27	^{3}H	22	<0.0073
Beatty, NV City Supply	1/16	23	^{3}H	< 6.4	<0.0021
			^{89}Sr	< 5.5	<0.18
			^{90}Sr	< 0.98	<0.33
			^{238}Pu	< 0.052	<0.0010
			^{239}Pu	< 0.080	<0.0016
			^{234}U	9.3	0.031
			^{235}U	0.11	<0.00037
			^{238}U	2.8	<0.0070
			^{226}Ra	0.089	0.30
Beatty, NV City Supply	7/1	23	^{3}H	< 7.7	<0.0026
			^{89}Sr	< 1.5	<0.050
			^{90}Sr	< 1.1	<0.37
Beatty, NV Nuclear Engineering Co.	1/15	23	^{3}H	< 7.7	<0.0026
			^{89}Sr	< 4.8	<0.16
			^{90}Sr	< 0.86	<0.29
			^{238}Pu	< 0.045	<0.00090
			^{239}Pu	< 0.083	<0.0017
			^{234}U	5.6	0.019
			^{235}U	0.067	<0.00022
			^{238}U	1.7	<0.0043
			^{226}Ra	0.22	0.73
Beatty, NV Nuclear Engineering Co.	7/1	23	^{3}H	< 7.7	<0.0026
			^{89}Sr	< 1.4	<0.047
			^{90}Sr	< 1.1	<0.37
			^{226}Ra	0.072	0.24

Table 11. (continued)

Sampling Location	Date	Sample Type[a]	Type of Radio-activity	Radioactivity Conc. ($10^{-9}\mu Ci/ml$)	% of Conc. Guide[b]
Indian Springs, NV USAF No. 1	1/23	23	^{3}H	20	<0.00067
			^{89}Sr	< 7.3	<0.24
			^{90}Sr	< 1.1	<0.37
			^{238}Pu	< 0.048	<0.00096
			^{239}Pu	< 0.099	<0.0020
			^{234}U	4.3	0.014
			^{235}U	0.037	<0.00012
			^{238}U	0.76	<0.0019
			^{226}Ra	0.45	1.5
Indian Springs, NV USAF No. 1	7/3	23	^{3}H	31	<0.010
			^{89}Sr	< 1.6	<0.053
			^{90}Sr	< 1.2	<0.40
Indian Springs, NV Sewer Co. Inc. Well No. 1	1/31	23	^{3}H	<13	<0.00043
			^{89}Sr	< 6.6	<0.22
			^{90}Sr	< 1.1	<0.37
			^{238}Pu	0.018[d]	<0.00036
			^{239}Pu	< 0.0092	<0.00018
			^{234}U	3.0	<0.010
			^{235}U	0.028	<0.0001
			^{238}U	0.68	<0.0017
			^{226}Ra	0.25	0.83
Indian Springs, NV Sewer Co. Inc. Well No. 1	7/3	23	^{3}H	<10	<0.00033
			^{226}Ra	0.28	0.93
Lathrop Wells, NV City Supply	1/15	23	^{3}H	< 7.3	<0.00024
			^{89}Sr	< 4.8	<0.16
			^{90}Sr	< 0.86	<0.29
			^{238}Pu	< 0.040	<0.00080
			^{239}Pu	< 0.052	<0.0010
			^{234}U	1.2	<0.0040
			^{235}U	0.022	<0.0001
			^{238}U	0.43	<0.0011

Table 11. (continued)

Sampling Location	Date	Sample Type[a]	Type of Radio-activity	Radioactivity Conc. ($10^{-9}\mu Ci/ml$)	% of Conc. Guide[b]
Lathrop Wells, NV City Supply	7/1	23	^{3}H	< 9.6	<0.00032
			^{89}Sr	< 1.4	<0.047
			^{90}Sr	< 1.0	<0.33
Shoshone, CA Shoshone Spring	1/18	27	^{3}H	< 7.7	<0.00026
			^{89}Sr	< 5.8	<0.19
			^{90}Sr	0.92[e]	<0.31
			^{238}Pu	< 0.043	<0.00086
			^{239}Pu	< 0.074	<0.0015
			^{234}U	3.6	0.012
			^{235}U	0.042	<0.00014
			^{238}U	1.2	<0.0030
Shoshone, CA Shoshone Spring	7/8	27	^{3}H	< 8.3	<0.00028
			^{89}Sr	< 2.6	<0.087
			^{90}Sr	< 1.2	<0.40
Springdale, NV Goss Springs	1/14	27	^{3}H	< 7.7	<0.00026
			^{89}Sr	< 4.7	<0.16
			^{90}Sr	< 0.83	<0.28
			^{238}Pu	< 0.048	<0.00096
			^{239}Pu	< 0.072	<0.0014
			^{234}U	5.0	0.017
			^{235}U	0.050	<0.00017
			^{238}U	1.3	<0.0033
			^{226}Ra	0.29	0.97
Springdale, NV Goss Springs	7/2	27	^{3}H	< 7.3	<0.00024
			^{89}Sr	< 1.5	<0.050
			^{90}Sr	< 1.1	<0.37
Springdale, NV Road D Windmill	7/2	23	^{3}H	< 7.3	<0.00024
			^{89}Sr	< 1.7	<0.057
			^{90}Sr	< 1.1	<0.37
			^{238}Pu	< 0.024	<0.00048
			^{239}Pu	< 0.011	<0.00022
			^{234}U	1.3	<0.0043
			^{235}U	0.016	<0.0001
			^{238}U	0.55	<0.0014
			^{226}Ra	0.01	0.033

[a]23 - Well
27 - Spring

[b]All on-NTS percentages are for radiation workers. All off-NTS percentages are for an individual in an uncontrolled area.

[c]Two-sigma error is ± $0.030 \times 10^{-9}\mu Ci/ml$.

[d]Two-sigma error is ± $0.016 \times 10^{-9}\mu Ci/ml$.

[e]Two-sigma error is ± $0.91 \times 10^{-9}\mu Ci/ml$.

Table 12. 1973 Samples From NTS Monthly Long-Term Hydrological Monitoring Program Not Previously Reported

Sampling Location	No. Samples Collected	No. Samples Analyzed	Type of Radio-activity	Radioactivity Conc. (10^{-9} μCi/ml)			% of Conc. Guide
				C_{Max}	C_{Min}	C_{Avg}	
NTS	4	3	^{3}H	<8.6	<7.6	<8.3	<0.01
Well 20A-2		2	^{89}Sr	<1.0	<1.0	<1.0	<0.01
		2	^{90}Sr	<1.1	<1.0	<1.1	<0.01
		2	^{238}Pu	<0.034	<0.030	<0.032	<0.01
		2	^{239}Pu	<0.028	<0.014	<0.021	<0.01
		2	^{234}U	3.1	2.9	3.0	<0.01
		2	^{235}U	0.040	0.036	0.038	<0.01
		2	^{238}U	0.70	0.70	0.70	<0.01
		3	^{226}Ra	0.33	<0.13	<0.20	<0.05
NTS	12	11	^{3}H	17.6	<5.1	<8.5	<0.01
Well 8		4	^{89}Sr	<2.0	<1.0	<1.5	<0.01
		4	^{90}Sr	<1.1	<0.90	<1.0	<0.01
		4	^{238}Pu	<0.061	<0.021	<0.014	<0.01
		4	^{239}Pu	<0.020	<0.010	<0.016	<0.01
		4	^{234}U	0.47	0.01	0.34	<0.01
		4	^{235}U	<0.010	<0.004	<0.007	<0.01
		4	^{238}U	0.20	0.090	0.013	<0.01
		1	^{226}Ra	0.16	0.16	0.16	0.04
NTS	9	9	^{3}H	<9.2	<6.4	<7.6	<0.01
Well J-12		3	^{89}Sr	<2.0	<1.0	<1.3	<0.01
		3	^{90}Sr	<1.1	<0.9	<1.0	<0.01
		3	^{238}Pu	<0.04	<0.02	<0.027	<0.01
		3	^{239}Pu	<0.021	<0.010	<0.017	<0.01
		3	^{234}U	0.99	0.94	0.96	<0.01
		2	^{235}U	0.016	0.013	0.015	<0.01
		3	^{238}U	0.22	0.10	0.16	<0.01
		0	^{226}Ra	--	--	--	--

Table 12. (continued)

Sampling Location	No. Samples Collected	No. Samples Analyzed	Type of Radio-activity	Radioactivity Conc. (10^{-9} µCi/ml) C_{Max}	C_{Min}	C_{Avg}	% of Conc. Guide
NTS	7	7	^{3}H	<8.3	<6.7	<7.2	<0.01
Well U3CN-5		5	^{89}Sr	<8.7	<2.0	<3.8	<0.01
		5	^{90}Sr	<1.2	<0.86	<1.1	<0.01
		2	^{238}Pu	<0.030	<0.020	<0.025	<0.01
		2	^{239}Pu	<0.020	<0.020	<0.020	<0.01
		2	^{234}U	4.6	2.8	3.7	<0.01
		2	^{235}U	0.042	0.015	0.029	<0.01
		2	^{238}U	1.3	0.73	1.0	<0.01
		6	^{226}Ra	2.6	0.87	2.0	0.5
NTS	12	11	^{3}H	<10.5	<5.7	<7.5	<0.01
Well A		5	^{89}Sr	<2.0	<1.0	<1.6	<0.01
		5	^{90}Sr	<1.20	<1.00	<1.1	<0.01
		4	^{238}Pu	<0.040	<0.020	<0.031	<0.01
		4	^{239}Pu	<0.040	<0.020	<0.029	<0.01
		4	^{234}U	5.7	4.8	5.2	<0.01
		4	^{235}U	0.081	0.033	0.054	<0.01
		4	^{238}U	1.7	1.4	1.5	<0.01
		8	^{226}Ra	2.4	0.01	0.46	0.12
NTS	12	9	^{3}H	115.2	57.6	90.3	<0.01
Well C		9	^{89}Sr	<7.7	<1.0	<3.0	<0.01
		9	^{90}Sr	5.0[a]	<0.90	<1.6	<0.01
		4	^{238}Pu	<0.048	<0.020	<0.036	<0.01
		4	^{239}Pu	<0.020	<0.010	<0.018	<0.01
		4	^{234}U	8.6	4.2	7.2	<0.01
		4	^{235}U	0.10	0.050	0.08	<0.01
		4	^{238}U	2.3	1.1	1.9	<0.01
		10	^{226}Ra	1.8	0.20	1.2	0.5

Table 12. (continued)

Sampling Location	No. Samples Collected	No. Samples Analyzed	Type of Radio-activity	Radioactivity Conc. (10^{-9} μCi/ml) C_{Max}	C_{Min}	C_{Avg}	% of Conc. Guide
NTS	12	10	^{3}H	12.8	<6.1	<8.4	<0.01
Well 5C		4	^{89}Sr	<2.0	<1.0	<1.8	<0.01
		4	^{90}Sr	<1.1	<0.90	<0.98	<0.01
		4	^{238}Pu	<0.049	<0.020	<0.032	<0.01
		4	^{239}Pu	<0.062	<0.020	<0.029	<0.01
		4	^{234}U	4.7	3.5	4.2	<0.01
		4	^{235}U	0.10	0.080	0.095	<0.01
		4	^{238}U	2.4	1.5	2.0	<0.01
		4	^{226}Ra	0.52	0.30	0.38	0.10
NTS	12	11	^{3}H	<8.6	<3.8	<7.3	<0.01
Army Well No. 1		4	^{89}Sr	<2.0	<1.0	<1.5	<0.01
		4	^{90}Sr	<1.1	<0.9	<1.0	<0.01
		4	^{238}Pu	<0.047	<0.020	<0.032	<0.01
		4	^{239}Pu	<0.020	<0.010	<0.016	<0.01
		4	^{234}U	2.5	0.81	1.9	<0.01
		4	^{235}U	0.031	0.014	0.025	<0.01
		4	^{238}U	0.88	0.64	0.77	<0.01
		6	^{226}Ra	0.97	0.37	0.72	0.18
Beatty, NV	9	7	^{3}H	<9.0	<7.0	<8.1	<0.01
Well 11S/48-1dd		4	^{89}Sr	<2.0	<1.0	<1.3	<0.01
		4	^{90}Sr	<1.1	<1.0	<1.1	<0.01
		4	^{238}Pu	<0.044	<0.030	<0.027	<0.01
		4	^{239}Pu	<0.024	<0.010	<0.017	<0.01
		4	^{234}U	7.9	0.81	5.2	<0.01
		4	^{235}U	0.076	0.035	0.054	<0.01
		4	^{238}U	1.7	1.1	1.4	<0.01
		7	^{226}Ra	1.4	0.17	0.46	0.15

[a]Two-sigma error term is ± 1.8 x 10^{-9}μCi/ml.

Table 13. 1974 Summary of Analytical Results for Off-NTS Long-Term Hydrological Monitoring Program

Sampling Location	Date	Sample Type[a]	Depth (m)[b]	Type of Radio-activity	Radioactivity Conc. (10^{-9} μCi/ml)	% of Conc. Guide
PROJECT GNOME						
Malaga, NM USGS Well No. 1	4/25	23	161	^{3}H	17	0.00057
				^{89}Sr	<1.1	<0.037
				^{90}Sr	1.4[c]	0.47
				^{226}Ra	3.8	13
Malaga, NM USGS Well No. 4	4/25	23	148	^{3}H	990,000	33
				^{89}Sr	<190	<6.3
				^{90}Sr	8100	2700
				^{226}Ra	12	40
Malaga, NM USGS Well No. 8	4/25	23	144	^{3}H	990,000	33
				^{89}Sr	<290	<9.7
				^{90}Sr	13,000	4300
				^{226}Ra	2.4	8.0
				^{137}Cs	23	0.12
Malaga, NM PHS Well No. 6	4/27	23	--	^{3}H	320	0.011
				^{89}Sr	<2.1	<0.070
				^{90}Sr	<0.91	<0.30
Malaga, NM PHS Well No. 8	4/27	23	--	^{3}H	<8.0	<0.00027
				^{89}Sr	<2.0	<0.067
				^{90}Sr	<0.89	<0.30
Malaga, NM PHS Well No. 9	4/27	23	--	^{3}H	<7.0	<0.00023
Malaga, NM PHS Well No. 10	4/27	23	--	^{3}H	<7.7	<0.00026
				^{226}Ra	0.32	1.1
Malaga, NM Pecos River Pumping Station	4/26	23	--	^{3}H	<8.0	<0.00027
Loving, NM City Well No. 2	4/26	23	--	^{3}H	<7.3	<0.00024
Carlsbad, NM City Well No. 7	4/26	23	--	^{3}H	29	0.00097

Table 13. (continued)

Sampling Location	Date	Sample Type[a]	Depth (m)[b]	Type of Radio-activity	Radioactivity Con. (10^{-9} μCi/ml)	% of Conc. Guide
			PROJECT SHOAL			
Frenchman, NV Frenchman Station	4/02	23	--	^{3}H	<5.7	<0.00019
				^{226}Ra	0.13	0.43
Frenchman, NV Well HS-1	4/02	23	--	^{3}H	<5.7	<0.00019
				^{226}Ra	0.18	0.60
Frenchman, NV Well H-3	4/02	23	--	^{3}H	<5.7	<0.00019
				^{226}Ra	1.0	3.3
Frenchman, NV Flowing Well No. 2	4/02	23	--	^{3}H	<5.7	<0.00019
				^{89}Sr	<2.9	<0.097
				^{90}Sr	<0.90	<0.30
				^{226}Ra	0.21	0.70
Frenchman, NV Hunts Station	4/02	23	--	^{3}H	<5.7	<0.00019
			PROJECT DRIBBLE			
Baxterville, MS City Water	3/01	23	--	^{3}H	90	0.0030
Baxterville, MS Lower Little Creek	3/04	22	--	^{3}H	210	0.0070
Tatum Salt Dome, MS Well HT-2C	3/03	23	108	^{3}H	35	0.0011
Tatum Salt Dome, MS Well HT-2M	3/02	23	--	^{3}H	35,000	1.2
	3/02	23	31	^{3}H	42,000	1.4
	3/02	23	183	^{3}H	35,000	1.2
	3/02	23	335	^{3}H	48,000	1.6
	3/02	23	488	^{3}H	45,000	1.5
	3/02	23	640	^{3}H	38,000	1.3
	3/02	23	716	^{3}H	38,000	1.3
	3/02	23	762	^{3}H	42,000	1.4
Tatum Salt Dome, MS Well HT-4	3/03	23	122	^{3}H	11	0.00037
Tatum Salt Dome, MS Well HT-5	3/03	23	183	^{3}H	<8.6	<0.00029

Table 13. (continued)

Sampling Location	Date	Sample Type[a]	Depth (m)[b]	Type of Radio-activity	Radioactivity Conc. ($10^{-9}\mu Ci/ml$)	% of Conc. Guide
Tatum Salt Dome, MS Well E-7	3/03	23	282	^{3}H	<8.3	<0.00028
Baxterville, MS Half Moon Creek	3/04	22	--	^{3}H	150	0.0050
Half Moon Creek Overflow	3/04	22	--	^{3}H ^{89}Sr ^{90}Sr	5100 <4.7 1.4	0.17 <0.16 0.47
Baxterville, MS T Speights Residence	3/01	23	--	^{3}H	110	0.0037
Baxterville, MS R. L. Anderson Residence	3/01	23	--	^{3}H	290	0.0097
Baxterville, MS M. Lowe Residence	3/01	23	--	^{3}H	230	0.0077
Baxterville, MS R. Ready Residence	3/01	23	--	^{3}H	38	0.0013
Baxterville, MS W. Daniels, Jr. Residence	3/01	23	--	^{3}H	90	0.0030
Lumberton, MS City Water Well No. 2	3/01	23	--	^{3}H	<6.7	0.00022
Purvis, MS City Water	3/01	23	--	^{3}H	<9.6	0.00032
Columbia, MS City Water Well No. 64B	3/04	23	--	^{3}H	25	0.00083
Baxterville, MS Pond W. of G.Z.	3/04	21	--	^{3}H	96	0.0032
PROJECT GASBUGGY						
Gobernador, NM Arnold Ranch	5/02	27	--	^{3}H	28	0.00093

Table 13. (continued)

Sampling Location	Date	Sample Type[a]	Depth (m)[b]	Type of Radio-activity	Radioactivity Conc. ($10^{-9}\mu Ci/ml$)	% of Conc. Guide
Gobernador, NM Lower Burro Canyon	5/01	23	--	^{3}H	<7.6	<0.00025
Gobernador, NM Bixler Ranch	5/02	23	--	^{3}H	21	0.00070
Blanco, NM San Juan River	5/02	22	--	^{3}H	420	0.014
Gobernador, NM Cave Springs	5/01	27	--	^{3}H	27	0.00090
Gobernador, NM Windmill No. 2	5/02	23	--	^{3}H	<22[d]	<0.00073
Gobernador, NM Bubbling Springs	4/30	27	--	^{3}H	240	0.0080
Dulce, NM City Water	5/01	21	--	^{3}H	380	0.013
Dulce, NM La Jara Lake	5/01	21	--	^{3}H	260	0.0087
				^{89}Sr	<3.8	<0.13
				^{90}Sr	6.7	2.2
Gobernador, NM EPNG Well 10-36	4/30	23	1097	^{3}H	38	0.0013
				^{89}Sr	<1.5	<0.050
				^{90}Sr	<1.1	<0.37
				^{226}Ra	0.17	0.57
PROJECT RULISON						
Rulison, CO Lee L. Hayward Ranch	5/14	23	--	^{3}H	480	0.016
Rulison, CO Glen Schwab Ranch	5/13	23	--	^{3}H	800	0.027
Grand Valley, CO Albert Gardner Ranch	5/13	23	--	^{3}H	510	0.017
				^{226}Ra	0.33	1.1
Grand Valley, CO City Water	5/13	27	--	^{3}H	170	0.0057
				^{226}Ra	0.76	2.5

Table 13. (continued)

Sampling Location	Date	Sample Type[a]	Depth (m)[b]	Type of Radio-activity	Radioactivity Conc. ($10^{-9}\mu Ci/ml$)	% of Conc. Guide
Grand Valley, CO 300 yds. N.W. of G.Z.	5/14	27	--	^{3}H	450	0.015
Anvil Points, CO Bernklau Ranch	5/13	27	--	^{3}H	350	0.012
Grand Valley, CO Battlement Creek	5/14	22	--	^{3}H	580	0.019
Grand Valley, CO CER Water Well	5/14	23	13	^{3}H	610	0.020
Rulison, CO Potter Ranch	5/13	27	--	^{3}H ^{226}Ra	540 0.094	0.018 0.31
				FAULTLESS EVENT		
Blue Jay, NV Highway Maintenance Station	4/11	23	--	^{3}H ^{226}Ra	<6.4 0.22	<0.00021 0.73
Warm Springs, NV Hot Creek Ranch	4/11	27	--	^{3}H ^{89}Sr ^{90}Sr	35 <2.3 <0.82	0.0012 <0.077 <0.27
Blue Jay, NV Blue Jay Spring	4/11	27	--	^{3}H ^{226}Ra	<6.4 0.25	<0.00021 0.83
Blue Jay, NV Six Mile Well	4/11	23	--	^{3}H	<6.4	<0.00021
Site C, NV Well HTH-2	4/09	23	184	^{3}H ^{226}Ra	<5.7 0.15	<0.00019 0.50

[a]21 - Pond, Lake, Reservoir, Stock Tank, Stock Pond
22 - Stream, River, Creek
23 - Well
24 - Multiple Supply - Mixed (A water sample consisting of mixed or multiple sources of water, such as well and spring.)
27 - Spring

[b]If depth not shown, water was collected at surface.

[c]Two-sigma counting error is ± 0.85 x $10^{-9}\mu Ci/ml$.

[d]Counting time was 100 minutes instead 200 minutes.

Table 14. 1973 Samples From Off-NTS Long-Term Hydrological Monitoring Program Not Previously Reported

Sampling Location	Date	Sample Type[a]	Depth (m)[b]	Type of Radioactivity	Radioactivity Conc. $10^{-9}\mu Ci/ml$	% of Conc. Guide
			PROJECT SHOAL			
Frenchman, NV Well HS-1	11/29	23	--	^{3}H	<8.0	<0.00027
Frenchman, NV Well H-3	11/29	23	--	^{3}H	<12	<0.00040
Frenchman, NV Hunt's Station	11/29	23	--	^{3}H	<7.0	<0.00023
				^{89}Sr	<4.8	<0.16
				^{90}Sr	<1.1	<0.37

[a]21 - Pond, Lake, Reservoir, Stock Tank, Stock Pond

22 - Stream, River, Creek

23 - Well

24 - Multiple Supply - Mixed (A water sample consisting of mixed or multiple sources of water, such as well and spring.)

27 - Spring

[b]If depth not shown, water was collected at surface.

APPENDIX A. RADIATION PROTECTION STANDARDS FOR OFF-NTS EXTERNAL AND INTERNAL EXPOSURE*

ANNUAL DOSE COMMITMENT

Type of Exposure	Dose Limit to Critical Individuals at Points of Maximum Probable Exposure (rem)	Dose Limit to Suitable Sample of the Exposed Population (rem)
Whole body, gonads or bone marrow	0.5	0.17
Other organs	1.5	0.5

CONCENTRATION GUIDES (CG's)

Network or Program	Sampling Media	Radio-nuclide	CG (μCi/ml)	Basis of Exposure
Air Surveillance Network	air	^{7}Be	1.1×10^{-8}	Suitable sample of the exposed population in uncontrolled area.
		^{95}Zr	3.3×10^{-10}	
		^{103}Ru	1.0×10^{-9}	
		^{106}Ru	6.7×10^{-11}	
		^{140}Ba	3.3×10^{-10}	
		^{141}Ce	1.7×10^{-9}	
		^{144}Ce	6.7×10^{-11}	
Noble gas and Tritium Surveillance Network, On-NTS	air	^{85}Kr	1.0×10^{-5}	Individual in controlled area.
		^{3}H	5.0×10^{-6}	
		^{133}Xe	1.0×10^{-5}	
Noble Gas and Tritium Surveillance Network, Off-NTS	air	^{85}Kr	1.0×10^{-7}	Suitable sample of the exposed population in uncontrolled area.
		^{3}H	6.7×10^{-8}	
		^{133}Xe	1.0×10^{-7}	
Water Surveillance Network	water	^{3}H	1.0×10^{-3}	Suitable sample of the exposed population in in uncontrolled area.
		^{89}Sr	1.0×10^{-6}	
		^{90}Sr	1.0×10^{-7}	
		^{238}Pu	1.7×10^{-6}	
		^{239}Pu	1.7×10^{-6}	

*"Radiation Protection Standards," Chapter 0524, ERDA Manual.

CONCENTRATION GUIDES (CG's) continued

Network or program	Sampling Media	Radio-nuclide	CG ($\mu Ci/ml$)	Basis of Exposure
Long-Term Hydrological Program	water	^{3}H	$3.0x10^{-3}$	Individual in uncontrolled area.
		^{89}Sr	$3.0x10^{-6}$	
		^{90}Sr	$3.0x10^{-7}$	
		^{238}Pu	$5.0x10^{-6}$	
		^{239}Pu	$5.0x10^{-6}$	
		^{234}U	$3.0x10^{-5}$	
		^{235}U	$3.0x10^{-5}$	
		^{238}U	$4.0x10^{-5}$	
		^{226}Ra	$3.0x10^{-8}$	
		^{3}H	$1.0x10^{-1}$	Individual in controlled area.
		^{89}Sr	$3.0x10^{-4}$	
		^{90}Sr	$1.0x10^{-5}$	
		^{238}Pu	$1.0x10^{-4}$	
		^{239}Pu	$1.0x10^{-4}$	
		^{234}U	$9.0x10^{-4}$	
		^{235}U	$8.0x10^{-4}$	
		^{238}U	$1.0x10^{-3}$	
		^{226}Ra	$4.0x10^{-7}$	

Since half of the reported Water Surveillance Network (WSN) samples were collected from surface waters as opposed to wells, the CG's for a suitable sample of the exposed population in an uncontrolled area was applied to all WSN samples for convenience. The majority of the off-NTS 'Long-Term Program' samples were from wells; therefore, the CG for an exposed individual in an uncontrolled area was used.

APPENDIX B. DOSE ASSESSMENT CALCULATIONS

METHOD

Since ^{133}Xe was the only radionuclide from NTS operations that was detected off-NTS (Beatty and Diablo), the 80-km, man-rem dose was calculated from the time-integrated concentrations of ^{133}Xe at these locations, the population information of Figure 5 and the dose equation $D = 0.25\ E\ \psi$,[1] where

- D = whole-body gamma dose in rem, assuming a quality factor of 1 rem/rad for the ^{133}Xe radiations,
- E = average gamma energy released per disintegration of ^{133}Xe, 0.053 MeV/dis,[2]
- ψ = time-integrated concentrations of ^{133}Xe, Ci-sec/m^3.

Indian Springs is the highest populated area within 80 km of the Control Point (CP-1 in Figure 5) of all tests; however, a sampler for noble gas is not operated there. Since Desert Rock is at a location which would be expected to intercept a ground-level release during night-time wind drainage conditions, the radiation dose at Desert Rock was conservatively assumed to be representative of the dose at Indian Springs. Lathrop Wells is another populated area within 80 km of CP-1 and not equipped with a noble gas sampler; however, the population there is less than Beatty or Indian Springs.

RESULTS

The results of these calculations, as follows, are less than more conservative dose estimates calculated for these locations from an atmospheric diffusion model suggested by Pasquill and modified by Gifford.[3]

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[1] "Meteorology and Atomic Energy," U. S. Atomic Energy Commission, Division of Technical Information, Oak Ridge, TN. July 1968. p. 339.

[2] Crocker, G. R. and Connors, M. A. "Gamma Emission Data for the Calculation of Exposure Rates From Nuclear Debris," USN RDL-TR-876. U. S. Naval Radiological Defense Laboratory, San Francisco, CA 94135. June 10, 1965.

[3] Turner, D. B. "Workbook of Atmospheric Diffusion." Environmental Protection Agency, Research Triangle Park, NC. Revised 1970. pp. 5-16.

Location	ψ Time-Integrated Concentration ($\mu Ci\text{-}s/m^3$)	Whole-Body Dose (μrem)	Dose Commitment Within 80 km (man-rem)
Beatty, NV	130	2	0.002
Indian Springs, NV	41*	0.5	<0.001
Diablo, NV	10	0.1	0**
		Total =	<0.003

* TIC at Desert Rock was assumed to exist at Indian Springs.

**Diablo is beyond 80 km, and no population resides between CP-1 and Diablo. Dose commitment at Diablo was 2×10^{-6} man-rem.

For comparison, the following table summarizes the results of the diffusion calculations, which are based upon a continuous release over a few hours, a total release of 663 Ci, and an average wind speed of 2 m/s.

Location	Stability Category	$\chi u/Q$ (m^{-2})	ψ ($Ci\text{-}s/m^3$)	Whole-Body Dose (μrem)	Dose Commitment Within 80 km (man-rem)
Beatty, NV	F	2.4×10^{-6}	9.0×10^{-4}	11	0.01
Indian Springs, NV	F	2.4×10^{-6}	9.0×10^{-4}	11	0.02
Diablo, NV	D	2.2×10^{-7}	3.3×10^{-5}	0.4	0*
				Total =	0.03

*Diablo is beyond 80 km, and no population resides between CP-1 and Diablo. Dose commitment at Diablo would have been 6×10^{-6} Man-rem.

CONCLUSIONS

The calculated doses which off-NTS residents at Beatty, Diablo or Indian Springs could have received from measured concentrations of ^{133}Xe were equal to or less than 0.001 percent of the radiation protection standard of 170 mrem/a for a suitable sample of the population and less than 0.002 percent of the dose one would receive from environmental background radiation, which ranges between 83-150 mrem/a for these locations. The estimated dose commitment within 80 km of the NTS was <0.003 man-rem, based upon the measured concentrations of ^{133}Xe. These dose estimates were about 1/10 of more conservative dose estimates based upon the reported quantity of ^{133}Xe released and atmospheric diffusion equations.